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PERSONAL.

Mr. John M. Walker, civil engineer, of Coffeyville, Kan., has been elected City Engineer of Independence, Kan.

Mr. Charles S. Currier, City Engineer, of Barre, Vt., has been appointed Superintendent of Water-Works of that city.

Mr. G. E. Hustis has been appointed General Superintendent of the West Shore R. R., with headquarters at Weehawken, N. J., to succeed Mr. C. W. Bradley, Assoc. Am. Soc. C. E., resigned.

Col. Peter C. Hains, Col. George L. Gillespie and Lieut.-Col. Oswald H. Ernst, all of the Corps of Engineers, United States Army, have been appointed Brigadier-Generals by President McKinley.

Mr. Edwin A. Miller has been appointed Chief Engineer of the Department of Parks for the Boroughs of Manhattan and the Bronx, New York city, to succeed Mr. Montgomery A. Kellogg, deceased.

Maj. William S. Stanton, Corps of Engineers, United States Army, has been ordered to Boston, Mass., to relieve Lieut.-Col. William R. Livermore, Chief Engineer of United States Volunteers, in addition to his other duties.

Dr. Louis Duncan, Past President of the American Institute of Electrical Engineers and head of the Electrical Engineering Department of Johns Hopkins University, Baltimore, Md., has been appointed Major in the United States Volunteer Engineers.

Mr. Eduardo Justo Chibas, Assoc. M. Am. Soc. C. E., M. Am. Inst. M. E., of New York city, has been appointed to the staff of Brig.-Gen. William Ludlow, M. Am. Soc. C. E., Chief of the Engineer Corps in the field, whose promotion was noted in our issue of May 12.

Lieut.-Col. John Biddle, M. Am. Soc. C. E., Corps of Engineers, U. S. Army, has been appointed Chief Engineer of a corps of the United States Volunteers. He will be relieved of his present duties at Nashville, Tenn. by Major Dan. C. Kingman, Corps of Engineers.

Lieut. Eugene W. Van C. Lucas, Assoc. M. Am. Soc. C. E., Corps of Engineers, U. S. Army, lately stationed at Willets Point, N. Y., has been appointed Major in the United States Volunteer Engineers. Other appointments from the Corps of Engineers to the United States Volunteer Engineers are: Capt. Geo. W. Goethals, to be Lieutenant-Colonel, and Lieut. John S. Sewall to be Major of the First Regiment; Capt. William Young to be Colonel of the Second Regiment.

Col. Theodore A. Bingham, Corps of Engineers, U. S. Army, in addition to his other duties, has been ordered to relieve Capt. Edward Burr, M. Am. Soc. C. E., Corps of Engineers, of the charge of the Washington Aqueduct and the increasing of the water supply of the city of Washington, D. C. Capt. Burr has been ordered to Port Tampa, Fla., to relieve Capt. Jas. L. Lusk, M. Am. Soc. C. E., Corps of Engineers, who has been appointed Lieutenant-Colonel and Chief Engineer of the United States Volunteers.

Col. Peter Conover Hains, M. Am. Soc. C. E., Corps of Engineers, U. S. Army, has been appointed Brigadier-General by President McKinley. He graduated from West Point in 1861 and was assigned to the artillery. In 1862 he was transferred to the Corps of Topographical Engineers and was appointed Assistant Topographical Engineer at the headquarters of the Army of the Potomac. Later he was appointed Chief Topographical Engineer, and in 1863 Chief Engineer of the 13th Army Corps, a year later being transferred to the Department of the Gulf. Since the war he has been on duty continuously with the Corps of Engineers.

Mr. Francis Vinton Greene, M. Am. Soc. C. E., President of the Barber Asphalt Paving Co., New York city, has been appointed a Brigadier-General by President McKinley. He was graduated from the United States Military Academy, West Point, N. Y., in 1870, at the head of his class, and was appointed to the artillery with service in North Carolina. In 1872 he was transferred to the Corps of Engineers and assigned to duty with the International Commission for marking the boundary between the United States and British America from the Lake of the Woods to the Rocky Mountains. In 1876 he was appointed to a position in the office of the Secretary of War and during the war in Turkey in 1877 was the representative of this government at the Russian army headquarters. From 1879 to 1885 he was Assistant to the Engineer Commissioner of the District of Columbia, in charge of highways and bridges. In 1885 he was ordered to West Point as Instructor in Military Engineering and in 1886 resigned from the army to engage in civil pursuits.

Mr. Ralph Modjeski, M. Am. Soc. C. E., consulting civil engineer, and Mr. Byron B. Carter, engineer of mines, have become associated with the firm of R. W. Hildreth & Co., of New York city, as Western representatives, with offices in the Monadnock Block, Chicago, and Mr. Oscar Sanne, consulting bridge engineer, with offices in the Colby & Abbot Bldg., Milwaukee, Wis., has been appointed representative in that city. In our issue of April 28 we noted the associating of Mr. Joseph Mayer, M. Am. Soc. C. E., and Mr. E. Ludlow Gould, civil engineer, with the firm, and also the removal of the New York office. The firm has opened an office in Philadelphia, at 1420 Chestnut St.

OBITUARY.

Mr. Theodore N. Walker, contractor, of St. Louis, Mo., died May 22, aged 33.

Mr. P. C. Patterson, contractor, of Deer Lodge, Mont., died May 21, aged 48.

Mr. Daniel Ryan, Buildings Commissioner of New York city, died May 26, aged 48.

Mr. Charles J. Goodwin, President and Treasurer of the Chapman Valve Mfg. Co., Indian Orchard, Mass., died May 27.

Mr. John Wood, head of the J. Wood Brothers & Company's Corliss Iron & Steel Works, Conshohocken, Pa., died May 28. He was born in Philadelphia, Sept. 6, 1816, and in 1841 opened an iron mill at Quitopohill Creek, near Lebanon, Pa.

Sir Lyon Playfair, K. C. B., LL. D., F. R. S., chemist and scientist, died at London on May 29. Sir Lyon Playfair was the son of Dr. George Playfair, Inspector-General of Hospitals in Bengal, and was born May 21, 1819, at Meerut, Bengal. He was educated at the universities of St. Andrews and Giessen and was a pupil of Graham and of Liebig. In 1843 he became Professor of Chemistry in the Royal Institute, Manchester, and from 1856 to 1869 he held the same position in Edinburgh University. He served on many royal commissions, interested in the sanitary conditions of towns, civil service, the expositions of 1851 and 1862, etc. In 1868 he was elected to Parliament and there distinguished himself by his speeches upon sanitary measures; he was Postmaster-General in 1873-4; Chairman of Ways and Means and Deputy Speaker in 1880-83, and was knighted in the latter year. Sir Lyon Playfair published numerous works on educational and scientific subjects, and edited an edition of Liebig's Chemistry, as applied to agriculture and physiology.

ENGINEERING SOCIETIES.

COMING TECHNICAL MEETINGS.

THE ENGINEERS' CLUB OF PHILADELPHIA.
June 4. Secy., L. F. Rondinella, 1122 Girard St., Philadelphia.

NATIONAL ELECTRIC LIGHT ASSOCIATION.
June 7-9. Annual meeting, Chicago, Ill. Secy., Geo. F. Porter, 136 Liberty St., New York city.

AMERICAN FOUNDRYMEN'S ASSOCIATION.
June 7-10. Annual meeting, Cincinnati, O. Secy., John A. Penton, Buhl Block, Detroit, Mich.

OHIO STREET RAILWAY ASSOCIATION.
June 8. Annual meeting, Columbus, O. Secy., Frank J. J. Sloat, Akron, O.

FRANKLIN INSTITUTE.
June 8. Secy., Wm. H. Wahl, 15 So. 7th St., Philadelphia, Pa.

ENGINEERING ASSOCIATION OF THE SOUTH.
June 9. Nashville, Tenn. Secy., C. B. Wilson, Nashville, Tenn.

BROOKLYN ENGINEERS' CLUB.
June 9. Secy., A. J. Provost, Jr., 191 Montague St., Brooklyn, N. Y.

NORTHWESTERN ELECTRICAL ASSOCIATION.
June 10. Secy., Theo. R. Mercein, 511 Montgomery Bldg., Milwaukee, Wis.

NORTHWESTERN TRACK AND BRIDGE ASSOCIATION.
June 10. Secy., D. W. Meeker, St. Paul, Minn.

MONTANA SOCIETY OF ENGINEERS.
June 11. Secy., Albert S. Hovey, Helena, Mont.

INDIANAPOLIS ENGINEERING CLUB.
June 11. Secy, Edson F. Folsom, Indianapolis, Ind.

WESTERN SOCIETY OF ENGINEERS.
June 11. "Three Months Among the Engineering Works of England and France," Prof. N. O. Whitney. Secy., N. L. Litten, Monadnock Block, Chicago, Ill.

ENGINEERS' CLUB OF KANSAS CITY.
June 13. Secy., F. W. Tuttle, Baird Bldg., Kansas City, Mo.

LOUISIANA ENGINEERING SOCIETY.
June 13. "Landscape Engineering as Applied to Park Improvements," Capt. Geo. H. Grandjean. Secy., J. F. Coleman, 712 Union St., New Orleans, La.

DENVER SOCIETY OF CIVIL ENGINEERS.
June 14. Secy., W. B. Lawson, 36 Jacobson Bldg., Denver, Colo.

CIVIL ENGINEERS' CLUB OF CLEVELAND.
June 14. Secy., Wm. H. Searles, Case Library Bldg., Cleveland, O.

AMERICAN WATER-WORKS ASSOCIATION.
June 14-16. Annual meeting, Buffalo, N. Y. Secy., Peter Milne, 95 William St., New York city.

BOSTON SOCIETY OF CIVIL ENGINEERS.
June 15. Secy., S. E. Tinkham, City Hall, Boston, Mass.

MASTER CAR BUILDERS' ASSOCIATION.
June 15-17. Annual meeting, Saratoga, N. Y. Secy., Jno. W. Cloud, 974 Rookery, Chicago, Ill.

ENGINEERS' CLUB OF CINCINNATI.
June 16. Secy., J. F. Wilson, P. O. Box 333, Cincinnati, O.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
June 16. Secy., C. W. Hunt, 220 W. 57th St., New York city.

ENGINEERS' CLUB OF COLUMBUS.
June 18. Secy., M. S. Hopkins, 14½ N. High St., Columbus, O.

TECHNICAL CLUB OF OMAHA.
June 20. Secy., J. Harry Lawrie, Omaha, Neb.

ENGINEERS' CLUB OF MINNEAPOLIS.
June 20. Secy., H. E. Smith, 1620 S. E. 4th St., Minneapolis, Minn.

AMERICAN RAILWAY MASTER MECHANICS' ASSOC'N.
June 20-22. Annual meeting, Saratoga, N.Y. Secy., John W. Cloud, 974 Rookery, Chicago, Ill.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
June 21. Secy., R. A. Fessenden, 410 Penn Ave., Pittsburg, Pa.

WESTERN FOUNDRYMEN'S ASSOCIATION.
June 22. Secy., A. Sorge, Jr., 1020 Monadnock Block, Chicago, Ill.

ENGINEERS' AND ARCHITECTS' ASSOCIATION OF SOUTHERN CALIFORNIA.
June 22. Secy., Frank H. Olmstead, Los Angeles, Cal.

CANADIAN ELECTRICAL ASSOCIATION.
June 28-30. Annual convention, Montreal. Secy., C. H. Mortimer, Confederation Bldg., Toronto, Can.

AMERICAN INSTITUTE ELECTRICAL ENGINEERS.
June 29. Secy., R. W. Pope, 26 Cortlandt St., New York city.

INTERNATIONAL MINING CONGRESS.
July 6-9. At Salt Lake City. Secy., W. D. Johnson, Salt Lake City, Utah.

AMERICAN SOCIETY OF R. R. SUPERINTENDENTS.
July 13-14. Annual meeting, Alexandria Bay, N.Y. Secy., C. A. Hammond, Asbury Park, N. J.

CIVIL ENGINEERS' SOCIETY OF ST. PAUL.—In response to an invitation of Mr. Thomas Lowry, president of the Twin City Rapid Transit Co., the society visited, on May 20, the Columbia Heights Iron Rolling Mills of Minneapolis.

ENGINEERS' AND ARCHITECTS' ASSOCIATION OF SOUTHERN CALIFORNIA.—At the meeting of this association, held on May 18, Mr. Theodore A. Eisen read a paper in which the condition confronting the engineers and architects at the end of the 19th century were outlined. Mr. James W. Warren read a paper entitled "Underground Conduits for Wires for Lighting, Power and Municipal Purposes."

THE FOUNDRYMEN'S ASSOCIATION OF PHILADELPHIA.—This association held a meeting on May 4. The main object of the meeting was to find out what effect the war was having upon the foundry business. The general opinion was that at first a slight depression would result, followed later by a steady demand and advanced prices. The results of the various American wars were reviewed to show that the general effect was beneficial.

CHICAGO ELECTRICAL ASSOCIATION.—The annual dinner, held on the evening of May 20, proved most enjoyable. Mr. W. Clyde Jones was toastmaster. The toasts were as follows: "A Glance Into the Past," George Cutter; "The Power of the Press," Cloyd Marshall; "Tribulations of the Electrical Inventor," K. B. Miller; "The Evolution of a Dynamo," E. P. Warner; "Specializing," Albert Scheible; "Electricity in Warfare," C. C. Mattison; "Shop Talk," Thomas G. Grier; "A Glance Into the Future," S. G. McMeen.

THE ENGINEERS' CLUB OF PHILADELPHIA.—The last meeting of this club was held May 21. Owing to the enforced absence of Mr. Joseph Appleton, who was to read a paper on "Recent Developments in the Application of Storage Batteries," Col. E. D. Meier read a paper on "The Diesel Motor." Mr. Chas. Piez exhibited and described views of a moving stairway and air conveyor. Prof. L. F. Rondinella gave some figures to show that with good instruments and careful work a very great degree of accuracy could be obtained in surveys made with the stadia.

CIVIL ENGINEERS' CLUB OF CLEVELAND.—At the meeting of this club, held May 24, Mr. Joseph R. Oldham presented a paper on the subject of the "Mechanical Theory of Naval Architecture," which was an interesting account of the International Congress of Naval Architects, held in London, in July, 1897, and a review of some of the papers read at that meeting. The theory of the stability of ships and the latest application of water ballast to secure stability by raising the center of gravity were explained. It was shown that some vessels having considerable stability in the normal position may capsize easily, while others which roll easily have a large moment of stability under increasing angles of inclination.

Wm. H. Searles, Secy.

NEW YORK ELECTRICAL SOCIETY.—The annual meeting of this society was held at Madison Square Garden, New York city, on May 26. The secretary, Mr. Geo. H. Guy, read the various reports. At the beginning of 1897 the membership was 397; this has been increased to 607 at the present time. The following officers were elected for 1898: President, Gano S. Dunn; Vice-Presidents, Willard E. Case, H. B. Coho, C. A. Doremus, F. A. Patterson, E. E. Higgins and Chas. Bilzard; Secretary, George H. Guy; Treasurer, Henry A. Sinclair.

Prof. Sidney H. Short, chief electrical engineer of the Walker Co., Cleveland, O., then read the paper of the evening on "The Outlook for Heavy Electric Traction." This was a brief historical review of the subject, starting with Davenport's experiments in 1835. Davidson's work three years later was mentioned, and the experiments of Siemens & Halske during 1879, after the battery had been discarded for the early forms of dynamos, were also mentioned. In 1885 a start was made in Denver, Colo., and Cleveland, O., the former work being conducted by Prof. Short, but it was not until 1887, when Sprague equipped the entire city lines of Richmond, Va., that investors could be tempted to take up and push electric railway work. The result is seen on all sides.

The growth of electric railway work was briefly described and illustrated by lantern slides which showed various types of suburban passenger and freight cars and trains. Third rail traction, as developed at the World's

Fair, on the New York, New Haven & Hartford R. R. and the Metropolitan Elevated of Chicago, was described with the aid of a series of excellent lantern views.

The fact that electricity was gradually but surely supplanting steam and other means for propelling elevated trains and handling suburban traffic was pointed out, and the reason for this was assigned to the centralization of power, permitting the burning of poor and much cheaper grades of coal, the use of more economical machinery, the reduction of operating force, increased speed and greater convenience and cleanliness. The average speed, owing to quicker acceleration, was fully doubled.

Animated pictures were exhibited, one showing the arrival and unloading of one of the Brooklyn Bridge electric trains at the New York end, another showing the approach of the Empire State Express of the New York Central Ry., the third a similar picture of the approach of an electric train on the New York, New Haven & Hartford Ry. The comparison thus afforded was an excellent argument in favor of the speed, cleanliness and comfort of the electric system.

The annual dinner of the society was held on the evening of May 27, at the Hotel St. Denis, with about 100 present. The following toasts were responded to: "The New York Electrical Society," Gano S. Dunn; "The American Institute of Electrical Engineers," Prof. F. B. Crocker; "The Technical Colleges," Joseph Wetzler; "The Yankee Militant," Capt. E. L. Zalinski, U. S. A.; "Sister Societies," Dr. W. McMurtrie; "The Newspaper Man," S. L. Coles; "Electrical Applications," F. W. Jones; "The Electrical Manufacturer," H. Ward Leonard; "What We Think of Electrical Engineering," C. O. Mailloux, representing the consulting engineer, and H. B. Coho for the contracting engineer. Mr. Geo. H. Guy rendered an original composition on the piano.

NEW PUBLICATIONS.

DAMS AND RESERVOIRS OF RHODE ISLAND.—Report of Walter C. Simmons, Commissioner of Dams and Reservoirs, for the Year 1897. Paper; 6 × 9 ins.; pp. 7; three illustrations.

This report has dwindled to but a few pages since the death of Mr. M. L. E. Stone, the former commissioner. Perhaps the old dams of the state have been described so fully as to need no further mention. The only work described in the present report is building of two wasteways, one being new and the other replacing one damaged by floods.

THE DISPOSAL OF REFUSE FROM THE CITY OF LONDON.—By G. Lister Sutcliffe. Reprinted from "The Public Health Engineer." Paper; 5½ × 8 ins.; pp. 20. Address Horsfall Furnace Syndicate, Leeds, England, or Hew Miller, Agent, 51 E. 44th St., New York city.

The greater part of this pamphlet is an abstract of a report on proposed changes in the disposal of the garbage and other refuse of the city of London, as the small area within the limits of the old city is called. Methods of disposal in some other English cities are briefly described.

PROVINCIAL BOARD OF HEALTH OF ONTARIO.—Report for the Year 1897. P. H. Bryce, M. D., Secretary, Toronto, Ont. Paper; 6½ × 9 ins.; pp. 133 + CLXXXV.; tables.

One of the most interesting parts of this report is a brief comparison of the work of this board with that done by the Massachusetts State Board of Health, together with a discussion of the value of scientific investigations on the part of such boards. The Ontario board does a large amount of good work, as its reports for the last fifteen years indicate. The present volume is largely taken up with routine reports of the work of the year and of local boards of health. The Ontario report on vital statistics for 1896 is issued as a separate volume.

WONDERLAND, '98.—By Olin D. Wheeler. Passenger Department, Northern Pacific Ry., St. Paul, Minn. Paper; 7 × 9⅝ ins.; pp. 103; illustrated; 6 cts.

The present issue of this annual published by the Passenger Department of the Northern Pacific Ry., makes an unusually handy little tourist's book of the great Northwest territory of the United States traversed by the company's lines. Chief among its merits, perhaps, is that it has been written with more attention to giving useful and reliable information than is usual in publications of this nature, and under the headings of "Rivers and Mountains," "The Lake of the Leech," "The Agricultural Northwest," "A Canoe Trip through the Park Region," "Yellowstone National Park," "Around Mount Rainier," and "Alaska and Klondike," there will be found much that is interesting not only to the tourist and sportsman but to the homeseeker and miner as well. Anyone who has thought of a Rocky Mountan trip for his vacation will be repaid by sending for "Wonderland, '98," and seeing what it has to offer in the way of sightseeing and sport before he decides finally upon his route.

SPAIN'S FOREIGN TRADE.—Bulletin No. 11, U. S. Department of Agriculture. Prepared by Frank H. Hitchcock, Chief of the Section of Foreign Markets, Washington, D. C. Paper; 9 × 6 ins.; pp. 47; 5 cts.

In 1895, the latest year for which official statistics are available, the merchandise imports of Spain were valued at $161,829,516, and the exports amounted to $155,355,759. This amounts to an aggregate of imports and exports of $317,185,275, a valuation somewhat larger than the annual average for the ten years 1886-1895. Of this foreign trade only 15.9% was transported by land; and more than half of the 84.1% of the maritime commerce was carried in foreign vessels until 1895, when Spanish shipping took a little over one-half. The most important countries with which Spain has dealings are: France, England, Cuba and the United States, about 70% of all her commerce being transacted with these countries. In 1891-95 31.11% of the total foreign trade of Spain was with France; England accounted for 22.05%; Cuba, 10.20%, and the United States 6.32%, or an annual value of $19,916,075. In these years the United States exported to Spain an annual average of $17,101,983. The annual average value of imports from Cuba was $7,380,418; from Puerto Rico, $4,357,571; from the Philippine Islands, $4,219,699, and from other colonial possessions, about $1,000,000 annually. Of the goods imported into Spain, agricultural products averaged in value $15,730,667 per year, for 1891-95; of the non-agricultural imports, coal, timber, machinery, fish, iron and steel and woolen goods, make up the bulk. The most important item in Spain's export trade is wine; the average yearly shipments being valued at $29,107,571, for the five years named; fruits and nuts come second among agricultural products. The leading non-agricultural exports are metals and mineral ores to the value of $17,-108,247 per year. Lead is the principal metal, and copper and brass, mercury, iron and steel follow in importance in the order given. In 1895 the Spanish merchant-marine comprised 1,783 vessels, with 719,572 aggregate tonnage; of these 523 were steamships with a combined tonnage of 526,340 tons.

TRADE PUBLICATIONS

The standard sizes for pamphlets and trade catalogues recommended by all the principal engineering societies of the United States are: 3 1-2 x 6 ins.; 6 x 9 ins., and 9 x 12 ins.)

POWER PUMPS.—Rumsey & Co., Ltd., Manufacturers and Hydraulic Engineers, Seneca Falls, N. Y., and 35 Dey St., New York city. Paper; 4½ × 6½ ins.; pp. 96; illustrations.

This catalogue describes a large variety of power pumps and contains some tables and other useful information.

MILLING MACHINERY FOR GOLD AND SILVER ORES.—The F. M. Davis Iron Works Co., Denver, Colo. Pamph.; 6 × 9 ins.; pp. 100.

This is an illustrated catalogue of a great variety of machinery for concentrating, sampling and reduction works.

PULLEYS AND CASTINGS.—Co-operative Foundry & Machine Co., Detroit, Mich. Paper; 4½ × 7½ ins.; pp. 32.

This company manufactures pulleys, shaft hangers, couplings, gear wheels, gate bars, and municipal supplies, including the Stuart safety manhole and cover. Its catalogue also shows a vertical compound yacht engine.

SPRINKLING CARS.—J. G. Brill Co., Philadelphia, Pa. Paper; 10 × 6 ins.; pp. 4; illustrated.

This is a brief description of sprinkling cars for use on street railways. The standard cars have capacities of 2,500 gallons and will sprinkle, the makers say, from 5½ to 8 miles of roadbed with one filling. The tanks are of steel. Sprinklers are fitted to each end of the car and will cover from 9 to 12 ft. outside the rail line.

FLUSHOMETER FOR WATER-CLOSETS.—The Kenney Co., New York, and the Walcott-Webster Mfg. Co., Chicago. Paper; 3½ × 5⅝ ins.; pp. 12.

The special feature of this device is that it does away with the usual individual tank, ball-cock, flush pipe, etc., and is noiseless in operation. This device, which is already in use in a number of office buildings, dwellings, etc., was described and illustrated in Engineering News, Oct. 21, 1897.

PIPE CUTTING AND PIPE TESTING APPARATUS.—S. G. Howe & Co., Detroit, Mich. Paper; 5½ × 7¾ ins.; pp. 4; also lithographed sheets.

The pipe cutting machine is intended for cutting holes in existing water mains under pressure for the purpose of making connections. The other apparatus is intended for testing pipe lines under pressure before filling in the trenches. A pressure pump is used, testing sections of the pipe line between gate valves.

INTERMITTENT FLUSH TANKS.—Pacific Flush Tank Co., 84 La Salle St., Chicago, Ill. Paper; 6 × 9 ins.; pp. 20; illustrated.

This is an illustrated description of the Miller and Rhoads-Williams automatic siphons, for intermittent flush tanks, used for sewer flushing and subsoil irrigation. It contains specifications for the construction of flush tanks, a table of rates of discharge and a large number of testimonials. Price lists are also given.

PUMPING ENGINES, FLEXIBLE PIPE JOINTS AND ADJUSTABLE GATE BOXES.—M. Walker, Fenton, Mich. Paper; 9 × 6 ins.; pp. 48; illustrated.

The Walker pump is used in connection with many water-works in Michigan and a few in other Western states. Heretofore it has been built mainly in small sizes, but the maker proposes to supply large pumps hereafter. The steam end of the pump is a plain slide valve engine. Quite a variety of flexible joints are shown by the illustrations, including full and half ball, hub, flange and screwed joints. The flexible joints are also described in a separate catalogue.

STEAM ENGINES AND BOILERS.—The Edward P. Allis Co., Milwaukee, Wis. Paper; 9¼ × 6¾ ins.; pp. 184.

This handsome publication consists mainly of engravings of the various types of large steam engines built by this company for electric light and electric railway power plants, rolling mills, hoisting plants, etc. There are also vertical, horizontal and centrifugal pumping engines, and the Reynolds screw pumping engine used for flushing the Milwaukee River, this having a modified form of propeller wheel. Boilers, condensers, feed-water heaters, etc., are also shown, and there are several views of the company's shops.

CONSTRUCTION NEWS.

CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

Bids to be opened.	Work.	Place.	Eng. News.
June 2.	Pipe sewers, Quincy, Mass. Advertised, Engineering News, May 26.		May 26
June 2.	Light and water bonds, Charlotte, N. Y.		May 26
June 2.	Masonry work, Jersey City, N. J.		May 26
June 2.	Electric light plant, Elkhorn, Wis.		May 26
June 2.	Conduits, Syracuse, N. Y.		May 26
June 2.	School building, Pittsburg, Pa.		May 19
June 2.	Electric lighting, Natchez, Miss.		Apr. 21
June 2.	Sewers, Rochester, N. Y.		May 26
June 2.	Iron bridge, Jersey City, N. J.		May 26
June 2.	Paving, Nashville, Tenn.		May 26
June 3.	Brick paving, Troy, N. Y.		May 26
June 3.	Repairing pavement, Utica, N. Y.		May 26
June 3.	Brick paving, Cincinnati, O.		May 26
June 3.	Street work, Roselle, N. J.		May 26
June 3.	Paving, Bangor, Me.		May 26
June 3.	Sewers, Cleveland, O.		May 12
June 3.	Stone pavements, Lansdowne, Pa.		May 19
June 3.	School building, East Cleveland, O.		May 19
June 3.	Macadamizing, Trenton, N. J.		May 26
June 3.	Court house, Parsons, W. Va.		May 26
June 3.	Paving (3 streets), Buffalo, N. Y.		May 26
June 3.	Curb and gutter, Massillon, O.		May 26
June 4.	Bridge superstructure, Leavittsburg, O.		May 26
June 4.	Water-works, Andover, N. B.		May 26
June 4.	Oil well, Bedford, Pa.		May 19
June 4.	Steel bridge, Valparaiso, Ind.		May 19
June 4.	Brick paving, Cambridge, O. Advertised, Engineering News, May 12.		May 12
June 4.	Pipe sewers, Cambridge, O. Advertised, Engineering News, May 12.		May 12
June 4.	Arc lights, Parsons, Pa.		June 2
June 4.	Hauling water pipe, Chicago, Ill.		June 2
June 4.	Repairing streets, Denver, Colo.		June 2
June 4.	Telford road, Wethersfield, Conn.		June 2
June 4.	Telford road, Westport, Conn.		June 2
June 4.	Street repairs, Denver, Colo.		June 2
June 5.	Electric motors (2), Taunton, Mass.		June 2
June 6.	Electric franchise, Gridley, Cal.		Apr. 21
June 6.	Paving, Toledo, O.		May 5
June 6.	Steel highway bridge, Pueblo, Colo.		May 12
June 6.	Steel bridges (3), Olivet, S. Dak.		May 19
June 6.	L't and water bonds, New Paynesville, Minn.		May 19
June 6.	Electric franchise (50 yrs), Bakersfield, Cal.		May 19
June 6.	Lighting hospital, Marysville, Cal.		May 19
June 6.	Paving and grading, Toledo, O.		May 19
June 6.	Sewerage system, Winooski, Vt. Advertised, Engineering News, May 26.		May 26
June 6.	Telephone plant, Indianapolis, Ind.		May 26
June 6.	Water-works franchise, Williamsburg, Ky.		May 26
June 6.	School building repairs, New York, N. Y.		May 26
June 6.	Bridge, Alliance, O.		May 26
June 6.	School building, Calmar, Ia.		May 26
June 6.	Fishery building, Wytheville, Va.		May 26
June 6.	Building, Danville, Ill.		May 26
June 6.	Pipe sewers, Plainfield, N. J.		May 26
June 6.	Light plant franchise, Williamsburg, Ky.		May 26
June 6.	Paving, etc., Albany, N. Y.		May 26
June 6.	Stone crusher and roller, Wausaw, Wis.		May 26
June 6.	Brick paving, Hornellsville, N. Y. Advertised, Eng. News, May 26 and June 2.		May 26
June 6.	Iron bridges (6), Paterson, N. J.		June 2
June 6.	Sewers, New Haven, Conn.		June 2
June 6.	School building, Johnstown, N. Y.		June 2
June 6.	Sewers, Darby, Pa.		June 2
June 6.	Artesian well, Casselton, N. Dak.		June 2
June 6.	Removing garbage, etc., Poughkeepsie, N. Y.		June 2
June 6.	Steel bridge, Harrisonville, Mo.		June 2
June 6.	Brick paving, Burlington, Ia.		June 2
June 6.	Curbing, grading, etc., Iowa City, Ia.		June 2
June 6.	Street bonds, Grand Rapids, Mich.		June 2
June 6.	Grading, St. Paul, Minn.		June 2
June 6.	Paving and sidewalks, Montgomery, Ala.		June 2
June 6.	Paving (8 streets), Louisville, Ky.		June 2
June 6.	Macadamizing, Southington, Conn.		June 2
June 6.	Macadamizing, East Hampton, Conn.		June 2
June 6.	Brick paving, Burlington, Ia.		June 2
June 7.	Bath house, Chicago, Ill.		June 2
June 7.	Electric light plant, Crowley, La.		June 2
June 7.	County bridges (5), Colfax, Wash.		June 2
June 7.	Bridge and plans, Allentown, Pa.		June 2
June 7.	Main sewer, Sing Sing, N. Y.		June 2
June 7.	Pipe sewers, Decatur, Ind.		June 2
June 7.	School building repairs, Brooklyn, N. Y.		June 2
June 7.	Extending water-works, Crowley, La.		June 2
June 7.	Water-works, Neodesha, Kan.		June 2
June 7.	Water pipe, etc., Kansas City, Mo. Advertised, Engineering News, June 2.		June 2
June 7.	Paving, Troy, N. Y.		June 2
June 7.	Broken stone, etc., New York, N. Y.		June 2
June 7.	Macadam road, Killingly, Conn.		June 2
June 7.	Gravel road, Granby, Conn.		June 2
June 7.	Grading and graveling, Stockton, Cal.		May 26
June 7.	Water bonds ($30,000), Norwalk, O.		May 26
June 7.	Water-works, Minden, Ia. Advertised, Engineering News, May 26.		May 26
June 7.	Smokestack, East Dubuque, Ill.		May 26
June 7.	Sewerage system, Marion, Ind. Advertised, Engineering News, May 19.		May 19
June 7.	Water bonds, Summit, Miss.		May 19
June 7.	Street work, Kewaunee, Wis.		May 19
June 7.	Macadamizing, etc., Mount Vernon, N. Y.		May 19
June 7.	Removing wreck, Wilmington, Del. Advertised, Eng. News, May 12 to June 2.		May 12
June 7.	County bridges (2), Alma, Kan.		May 12
June 7.	Steel bridge and plans, Franklin, Ky. Advertised, Engineering News, May 12.		May 12
June 7.	Arc lights (50), Greenville, Miss.		Apr. 28
June 8.	Bridge, Salem, Ore.		May 19
June 8.	County road, Bozeman, Mont.		Apr. 21
June 8.	Road (3½ miles), Bozeman, Mont.		May 26
June 8.	Fire water tower, New York, N. Y.		May 26
June 8.	By-pass, Chicago, Ill. Advertised, Engineering News, May 26.		May 26
June 8.	Local sewer, Akron, O.		May 26
June 8.	Grading, etc., Akron, O.		May 26
June 8.	Removing garbage, etc., Hoboken, N. J.		May 26
June 8.	Light and water bonds, Fosston, Minn.		June 2
June 8.	Bath bridge, Hoboken, N. J.		June 2
June 8.	Dredging in canal, Southampton, N. Y. Advertised, Engineering News, June 2.		June 2
June 8.	Road work, Canaan, Conn.		June 2
June 8.	Mortar carriages, Washington, D. C.		June 2
June 8.	Road, Freehold, N. J.		June 2
June 9.	Artesian well, Norwood, Pa. Advertised, Engineering News, June 2.		June 2
June 9.	Pipe sewers, Baraboo, Wis.		June 2
June 9.	Roadway, walks, etc., New York		June 2
June 9.	Macadamizing, New Haven, Conn.		June 2
June 9.	Water-works, Pipestone, Minn.		May 26
June 9.	Electric light plant, Fairfield, Ill.		May 26
June 9.	Water pipe, Chicago Junction, O. Advertised, Eng. News, May 26 and June 2.		May 26
June 9.	Water-works, Sharpsville, Pa. Advertised, Engineering News, May 19.		May 19

June 9. Paving (30,000 sq.yds.), Lima, O. .....May 12
June 10. Storm sewer, Cedar Rapids, Ia. .....June 2
June 10. Highway bridge, Argenta, Ill. .....June 2
June 10. Brick sewers, Iowa City, Ia. .....June 2
June 10. Repairing sewer, St. Louis, Mo. .....June 2
June 10. Gravelling, grading, etc., Athens, O. .....June 2
June 10. Brick paving, Holyoke, Mass. .....June 2
Advertised, Engineering News, June 2.
June 10. Macadam road, Rockhill, Conn. .....June 2
June 10. Brick paving, Troy, N. Y. .....June 2
June 10. Brick paving, Newport, Ky. .....June 2
June 10. Elevator, Abercrombie, N. Dak. .....June 2
June 11. Macadamizing, etc., East Haddam, Conn. ..June 2
June 11. Granite arch bridge, Brattleboro, Vt. ....June 2
June 11. Street work, Washington, D. C. .....June 2
June 11. Road, Huntington, W. Va. .....May 19
June 11. Army building, etc., Seattle, Wash. .....May 19
June 11. Brick paving, Swanton, O. .....May 26
Advertised, Engineering News, May 26.
June 11. School building, Ludlow Falls, O. .....June 2
June 13. Brick paving, curb, etc., So. Bend, Ind. ....May 19
June 13. Pipe sewer (2,750 ft.), Lafayette, Ind. .....May 19
June 13. Pipe sewers (2 streets), South Bend, Ind. ..May 19
June 13. Stone block paving, Toledo, O. .....May 26
June 13. Pipe sewers, Toledo, O. .....June 2
June 13. Water pipe, Cleveland, O. .....June 2
June 13. Sewers, Lapeer, Mich. .....June 2
June 13. Pipe sewers, Pontiac, Ill. .....June 2
Advertised, Engineering News, June 2.
June 13. Buildings, Kanawha, W. Va. .....June 2
June 13. School building, Wapakoneta, O. .....June 2
June 13. Water pipe, Washington, D. C. .....June 2
Advertised, Engineering News, June 2.
June 13. Grading, Wharton, Tex. .....June 2
June 13. Court house repairs, Wharton, Tex. .....June 2
June 14. Plans for bridge, Tuckahoe, N. J. .....June 2
Advertised, Eng. News, June 2 and 9.
June 14. Brick sewers, Springfield, Mass. .....June 2
Advertised, Eng. News, June 2 and 9.
June 14. Pipe sewers (2,500 ft.), Rahway, N. J. ....June 2
June 14. Truss bridge, Columbus, O. .....May 26
June 14. Brick paving, Binghamton, N. Y. .....May 26
June 14. Stone substructure, Mercer, Pa. .....May 26
June 14. Macadamizing (12 miles), Indianapolis, Ind. May 26
June 14. Iron fence, Northampton, Mass. .....May 26
June 14. Steam heating plant, Wahpeton, N. Dak. ....May 26
June 14. Bridge and viaduct, Middletown, O. .....June 2
June 15. School building plans, Shreveport, La. ....May 26
June 15. Jail building, Charlotteville, Va. .....May 26
June 15. Municipal building, Stratford, Ont. .....May 26
June 15. Pump, gas engine, etc., Oil City, Pa. .....May 12
Advertised, Eng. News, May 12 to 26.
June 15. Railway, Robson, B. C. .....June 2
June 15. Bridge and plans, Owosso, Mich. .....June 2
June 15. Pipe sewers (5,600 ft.), Elizabeth, N. J. ..June 2
June 15. Road work, Elizabeth, N. J. .....June 2
June 16. Levee work, New Orleans, La. .....June 2
June 16. Sewers (4 miles), North Tarrytown, N. Y. ..June 2
Advertised, Engineering News, June 2.
June 16. Steel bridges (2), Towanda, Pa. .....June 2
June 16. Ice plant, Dayton, O. .....June 2
June 16. Paving, curbing, etc., Owasso, Mich. .....June 2
June 16. Army buildings, New London, Conn. .....May 26
June 16. School building, Onslow, Ia. .....May 26
June 16. Iron bridges (4), Mercer, Pa. .....May 26
June 16. Paving, Owasso, Mich. .....May 26
Advertised, Eng. News, May 26 and June 2.
June 17. Sewers, Cambridge Springs, Pa. .....June 2
June 17. Court house, Savannah, Mo. .....June 2
June 17. Court house, Hillsdale, Mich. .....June 2
June 18. Water bonds ($25,000), Monrovia, Cal. .....June 2
June 18. Asphalt paving, Zanesville, O. .....May 26
June 18. Street work, Marietta, O. .....May 26
June 18. Electric light plant, Fitzgerald, Ga. .....May 5
June 18. Water-works, etc., Fitzgerald, Ga. .....May 5
June 20. Water-works bonds, Prescott, Ariz. .....May 26
June 20. Bonds, Berea, O. .....May 26
June 20. Cleaning streets, Washington, D. C. .....May 26
June 20. Light station, Oswego, N. Y. .....May 26
June 20. School building, Glenville, O. .....June 2
June 20. Water tank, Yankton, S. Dak. .....June 2
June 20. Macadamizing, Morristown, N. J. .....June 2
June 21. Electric light plant, Wellington, O. .....June 2
Advertised, Eng. News, June 2 to 16.
June 21. Hospital building, Sandusky, O. .....June 2
June 21. Brick paving, De Kalb, Ill. .....June 2
Advertised, Eng. News, June 2 and 9.
June 21. Water bonds ($3,000), Greenwich, O. .....May 26
June 22. Masonry substructure, Youngstown, O. .....May 26
June 22. Reformatory building, Mansfield, O. .....May 26
June 22. Garbage bonds, etc., Milwaukee, Wis. .....May 26
June 22. Water-works, etc., Wellington, O. .....June 2
Advertised, Eng. News, June 2 to 16.
June 22. Sewerage system, Concord, Mass. .....June 2
Advertised, Engineering News, June 2.
June 22. Bridge, Youngstown, O. .....June 2
June 23. Pier, dredging, etc., Cleveland, O. .....May 26
Advertised, Eng. News, May 26 to June 16.
June 23. Post office building, San Francisco, Cal. ....May 26
June 23. Hospital buildings, Massillon, O. .....June 2
June 23. Paving, etc., Lima, O. .....June 2
June 24. School building, San Diego, Cal. .....June 2
June 24. Bridge, Cleveland, O. .....June 2
June 24. Tow-boat service, St. Louis, Mo. .....June 2
June 24. Electric plant, Hawthorne, Australia ....Apr. 14
June 24. Brick paving (10 000 sq.yds.), Lima, O. ....May 19
June 25. Railway bridge, Chicago, Ill. .....May 12
Advertised, Eng. News, May 12 and 19.
June 25. Electric plant, Atlanta, Ga. .....June 2
June 25. Improving road, Cincinnati, O. .....June 2
June 25. School building, Cleveland, O. .....June 2
June 27. Paving, Toledo, O. .....June 2
June 27. Pipe sewers, South Bend, Ind. .....June 2
June 27. Sidewalks, grading, etc., South Bend, Ind. ..June 2
June 28. Gravel roads (4 miles), Indianapolis, Ind. ..June 2
June 28. Brick paving (12,000 sq.yds.), Warren, O. ..June 2
June 29. U. S. building work, Kansas City, Mo. ....June 2
Advertised, Eng. News, June 2 and 9.
June 29. Paving, Warren, O. .....June 2
June 29. River work, Chicago, Ill. .....May 12
Advertised, Eng. News, May 12 and 19.
June 30. School building, Zanesville, O. .....June 2
July 1 Water power, Madras India .....Oct. 28
July 1. Plans for sewer system, Formby, Eng. ....Apr. 7
July 1. Plans for sewer system, Cohoes, N. Y. ....Apr. 28
Advertised, Eng. News, Apr. 28 and May 5.
July 1. Power plant, Sault Ste. Marie, Mich. .....May 26
Advertised, Eng. News, April 14 to 28.
July 2. Water-works, Summit, Miss. .....May 19
July 7. Brick paving (20 000 sq.yds.), Lima, O. ....May 19
July 7. Iron or steel bridge, Kingfisher, Okla. Ter. ..May 19
July 8. Bridge, Roseburg, Ore. .....June 2
July 10. School building, Rush City, Minn. .....May 26
July 11. Bridge, Breckenridge, Minn. .....May 19
July 15. Electric plant, Lamar, Colo. .....May 5
July 20. Bridges, etc. (11), Chicago, Ill. .....June 2
Advertised, Engineering News, June 2.
July 20. Embankment, etc., Lemont, Ill. .....June 2
Advertised, Engineering News, June 2.
July 20. Capitol building plans, Phoenix, Ariz. .....June 2
July 25. Water-works, Winnipeg, Man. .....June 2
Advertised, Eng. News, June 2 to 23.

Aug. 15. Exhibition bldg. plans, Glasgow, Scotland. .June 2
Aug. 23. Water pipe, Coolgardie, West Australia. ..June 2
Aug. 31. Custom house, Guayquil, Ecuador. .....Apr. 21
Sept. 12. Hospital plans, San Francisco, Cal. .....Mar. 24
Oct. 24. Markets, etc., Belem, Brazil .....Apr. 28

RAILWAYS.

ADDISON & PENNSYLVANIA.—C. W. Goodyear, Buffalo, N. Y., informs us that this line now connects with the Buffalo & Susquehanna R. R. at Galeton, Pa., and that another connection will be made at Gaines, about five miles east of Galeton; the track and bridges will also be improved. F. H. Goodyear, of Buffalo, is president of the New York division, and M. E. Olmstead, president of the Pennsylvania division of this railway; Henry Harden, Ch. Engr., Galeton, Pa.

CALUMET WESTERN.—Reports state that this company has acquired the right of way for its proposed line from South Chicago across the Calumet River to Hegewisch, Ill., a distance of four miles. It is also said that the road will be built and controlled by the Pennsylvania, the Michigan Central and the Chicago, Rock Island & Pacific Ry. Cos. The Calumet Western was incorporated Sept. 2, by J. T. Brooks, Salem, O.; Joseph Woods, Pittsburg, Pa.; F. W. Belz, Chicago, Ill., and others, as stated in our issue of Sept. 9.

CHICAGO INDIANAPOLIS & LOUISVILLE.—Ferd. Hall, Ch. Engr., Chicago, Ill., informs us that the final survey has been made for the change in line to be made between Clear Creek and Harrodsburg, Ind., about 12 miles, but that the right of way had not all been obtained. The time of awarding the contract will depend largely upon the success in securing right of way.

COLUMBUS, LANCASTER & WELLSTON.—W. H. Stevenson, Pres. and Gen. Mgr., Lancaster, O., informs us that several new branches to this railway will be built, with new sidings, but that definite information can not be given at present. The construction of new bridges and stations is in progress.

COLUMBIA & WESTERN.—Bids are asked until June 15, according to press reports, for the construction of this proposed extension of the Canadian Pacific Ry. from West Robson to Penticton, via Cascade City, Grand Forks, Greenwood and Midway, B. C., a distance of 180 miles; estimated cost, $3,000,000. F. P. Gutelius, Acting Ch. Engr., Trail, B. C.; F. Aug. Heinze, Pres., Butte, Mont.

ELLWOOD SHORT LINE.—Reports state that the Pittsburg & Western Ry. Co., of which T. M. King, of Allegheny, Pa., is the president, has purchased this railway for about $250,000. This line was built about three years ago by Henry W. Hartmann, of Pittsburg, and is said to have cost $500,000. It is three miles long and has two bridges along its course, one of which is built of steel and is 640 ft. in length.

GALLATIN.—Reports state that this company will let contracts some time this month for the construction of about 40 miles of its proposed railway from Three Forks, Mont., to coal fields, 100 miles distant. The company was incorporated in Washington in March, with a capital stock of $1,000,000. W. W. D. Turner, Pres.; Frank A. Hall, Vice-Pres. and Gen. Mgr., Bozeman, Mont.

GULF, TEXAS & NORTHERN.—This company was incorporated in Texas, May 27, with a capital stock of $200,000, to construct a railway from Orange to Marshall, Tex., a distance of about 200 miles. The incorporators are: D. C. Plumb, C. W. Wiggins, John B. Mesny, Jas. C. Meeks, of Chicago, and others.

ILLINOIS.—Bids are asked by the sanitary district of Chicago, Ill., until July 20, for the building of a double-track railroad embankment upon the proposed changed location of the Atchison, Topeka & Santa Fe Ry. crossing, the Des Plaines River and the main channel of the Sanitary District on section 20, township 37, range 11, at Lemont, Ill., and all necessary collateral work, including the grading of highway and street approaches; also for the removal of the rock remaining in the main channel, where it is now crossed by the said A., T. & S. F. Ry. tracks, so soon as the existing tracks can be abandoned. Bond required, $10,000. Advertised in Engineering News. William Boldenweck, Pres. Bd. Trustees.

KANSAS CITY, ELDORADO & SOUTHERN.—B. A. Aldrich, Secy. and Treas., Middle States Construction Co., Rialto Bldg., St. Louis, Mo., contractor for the construction, is in the market for the purchase of two standard and one combination second-hand passenger coaches, ten flat cars and two 30-ton locomotives. Mr. Aldrich, who has promoted and built this line, advises our representative that it extends from Walker to Eldorado Springs, Mo.; that all grading is completed, and that the rails, ties, steel for bridges, etc., necessary to complete the line, are all on the road, and that he expects to begin operating the line within 30 days.

KANSAS & TEXAS COAL RY.—This company has recently been incorporated in Missouri to build and operate about ten miles of railway in Macon and Randolph counties, connecting Ardmore, which is on a short branch from the Wabash R. R., with Bevier in Macon county, on the Burlington Lines in Missouri. This company owns and operates one of the largest coal properties in the states of Arkansas, Kansas, Missouri and the Indian Territory. The company at present has mines both at Ardmore, Mo., and Bevier, Mo., and owns a considerable part of the land over which this line will be built. The object of the line is the development of the coal field which is now mined only at its northern end of Bevier and its southeastern extremity at Ardmore. This is the largest body of mineable coal in Missouri, and from which there has been the largest production in the state for a number of years, and its production is constantly increasing. The contract for the line has been let and also purchases made of rails and track supplies. No additional equipment will be necessary over that which the company already owns in the operation of the three-mile branch from Excello, Mo., to Ardmore, Mo. It is expected that the new line will be in operation by October 1. The officers of the company are B. F. Hobart, Pres.; Geo. B. Leighton, Vice-Pres.; principal offices are at St. Louis, Mo.

LONG ISLAND.—Press reports state that work is rapidly progressing on the extension of the North Shore division of this railway from Great Neck to Port Washington (L. I.), N. Y. The abutments of the bridge on Grace Ave., Manhasset, have been completed, the grading of the approach is finished, and it will be ready for use upon the placing of the span. The bridge across Manhasset Valley is also in position, and the riveters are at work on the finishing touches; this is one of the highest railway bridges in the vicinity of New York, and crosses the meadows over what has always been considered as almost a bottomless quicksand. The grading of the road from the east side of Manhasset to Port Washington is almost completed, and it is expected that the new line will be opened to travel in July. P. D. Ford, Ch. Engr., Long Island City, N. Y.

MINNEAPOLIS & ST. LOUIS.—H. G. Kelley, Ch. Engr., Guarantee Loan Bldg., Minneapolis, Minn., informs us that this company is relaying 23 miles of 80-lb. steel rails, 12 miles of 70-lb. and 45 miles of 60-lb. Five new single-track through plate girders, with 85-ft. span on masonry piers and designed for 142-ton engines, are also to be constructed.

MOSCOW, CAMDEN & SAN AUGUSTINE.—This company has been incorporated in Texas, with a capital stock of $250,000, to build a line from Moscow to Camden, Tex., about 50 miles. The incorporators are C. H. Jones, Galveston, Tex.; J. E. McAshan, Houston, Tex.; E. A. Carter, Camden, Tex., and others.

NASHVILLE & KNOXVILLE.—A. J. Crawford, Pres., Terre Haute, Ind., informs us that this company is now having surveys made for a new line from Monterey to Glen Mary, via Glades, Tenn., a distance of about 35 miles. The present line runs from Lebanon to Monterey, with a branch from Junction, on the main line, to Carbon, a distance of 87.8 miles.

OHIO.—Our correspondent informs us that surveys have been completed for a coal railway to be built for the Ridgeway-Burton Coal Co., Massillon, O. The line runs through a very hilly country, the maximum grade being 2.47% and maximum curvature 12°. Work on construction is expected to begin soon. Engr., J. H. Hall, Canton, O.

PECOS VALLEY & NORTHEASTERN.—R. C. Cushing, of Chicago, Ill., is stated to have received the general contract for the construction of this proposed railway in New Mexico. Gen. Mgr., E. O. Faulkner, Eddy, N. Mex.

POCAHONTAS.—Reports state that work has begun on the Pocahontas Ry., which will run from a point in Garrett county, near Frostburg, Md., via Granville, to Sand Patch, Pa., on the Baltimore & Ohio R. R.

RICHLAND & MAHONING.—This company was incorporated in Ohio, May 25, with a capital stock of $150,000, to build and operate a steam railway from Mansfield through the counties of Richland, Ashland, Wayne, Stark, Portage, Trumbull and Mahoning to a point on the boundary line between Ohio and Pennsylvania. The incorporators are Charles W. French, V. A. Dehnel, S. T. Cummings and C. Hedges.

SEA COAST.—This company has been incorporated in New Jersey, with a capital stock of $1,200,000, to operate the South Jersey R. R. system. The line was purchased by Robert P. Linderman, Pres. Bethlehem Iron Co., South Bethlehem, Pa., and others, March 29, at public auction.

ST. LOUIS, CENTRAL ILLINOIS & CHICAGO.—This company has been incorporated in Missouri, with a capital stock of $1,000,000, to construct a railway from Venice, Mo., via Collinsville and Troy to a point of intersection with the Chicago & Eastern Illinois Railroad, near Duvall, in Shelby county. Principal offices at East St. Louis, Ill. The directors are A. A. Barnes, Indianapolis, Ind.; W. B. Dean, St. Louis; E. L. Waddell, of East St. Louis; J. S. P. Gordon, and Mrs. Grace A. Wilson, of Collinsville, Ill.

SOUTHEASTERN.—Press reports from Manitoba state that grading on this proposed line has commenced at a point six miles from St. Boniface. Contractor Sinnott has the first seven miles; Contractor Fisher the next three, and Geo. H. Strevel the balance to St. Anne des Chenes, Manitoba. Mr. McArthur is getting out 100,000 ties for the line at Lake Winnipegoosis, and in addition several thousand have been purchased at Rat Portage and in Winnepeg, Man. Quantities of rails bought some months ago are now lying in Port Arthur ready for shipment when required.

STREET AND ELECTRIC RAILWAYS.

PLYMOUTH, MASS.—It is reported that the Plymouth & Sandwich St. Ry. Co. has been organized and the special charter by the legislature accepted. A survey will be made in order to determine the best location, and it is thought that a section of the line, as far as Manomet Bluffs, will be built this spring. The distance between Plymouth and Sandwich is about 20 miles.

BINGHAMTON, N. Y.—The Binghamton R. R. Co. is said to have made a contract with the Consolidated Car Fender Co., Providence, R. I., for the equipment of its cars with fenders similar to those used by the Metropolitan Tracti n Co., in New York. Pres., B. Tracy Rogers; Gen. Mgr., J. P. E. Clark.

CANANDAIGUA, N. Y.—H. B. Ferguson, Gen. Mgr., Canandaigua Electric Light & R. R. Co., informs us that the proposed line to Manchester is not yet assured, but that if built it will be by a new company, and will probably be operated by his company. The present line is three miles in length. If the citizens are enabled to raise $20,000 as a guarantee the extension will be undertaken by Buffalo capitalists.

LITTLE FALLS, N. Y.—The Little Falls & Herkimer St. Ry. Co. has filed a certificate of extension in the office of the county clerk, whereby it proposes to build an extension on the north side of the Mohawk River between Little Falls and Herkimer. Pres., John V. Quackenbush.

PEEKSKILL, N. Y.—Chas. N. Wells, an incorporator of the Peekskill Traction Co., of Peekskill, informs us that the proposed electric railway will run from this town through Cortlandt and Yorktown, Westchester county and will cover about 12 to 14 miles. Preliminary work, as to obtaining the right of way, etc., is expected to be completed by the middle of June. Pres., Frank Frye, Peekskill.

JERSEY CITY, N. J.—The Jersey City Street and Water Board has passed an ordinance permitting the North Hudson County Ry. Co. to substitute electricity for horses as the motive power on its Grove St. line, from Jersey City to Hoboken.

NEWARK, N. J.—The Newark board of works, May 26, granted the application of the Newark & South Orange Ry. Co. for franchises to construct an extension of its lines over five miles of streets.

FAYETTEVILLE, W. VA.—The Fayetteville County Electric Ry. Co. was incorporated in West Virginia, May 25, with a capital stock of $30,000, to operate an electric railway from Fayette Station to Fayetteville. The incorporators are: L. G. Gains, A. W. Hamilton, Morris Harvey, A. D. Preston and Joe F. White, all of Fayetteville.

ANNISTON, ALA.—It is reported that the Westinghouse Electric & Mfg. Co., of Pittsburg, has been awarded the contract for the new power plant for the Consolidated St. Ry. Co., which is changing its system from horse to electric motor power.

CHATTANOOGA, TENN.—The board of aldermen has passed an ordinance granting the Chattanooga Electric Ry. the right of way over certain streets in this city.—The Chattanooga & North Side St. Ry. Co. informs us that it does not intend to extend its line from Valombrosa to White Oak Springs, as was reported.

ALEXANDRIA, IND.—The commissioners of Madison county, May 21, granted a franchise to the Indiana Traction Co. for the construction of an electric street railway between Alexandria and Elwood, via Marion.

CLIO, MICH.—The village council has granted a franchise to the Saginaw Suburban Ry. Co. to construct a line at this place.

DETROIT, MICH.—We are informed that the Detroit, Ypsilanti & Ann Arbor Ry. Co. were to open its electric railway for passenger and freight business on June 1. The line will run from Detroit to Ann Arbor, a distance of 38 miles. The principal office of the company is in the Union Trust Bldg., Detroit.

SAUGATUCK, MICH.—This city has voted to issue $2,500 in bonds to aid in the construction of the Saugatuck, Douglas & Lake Shore Electric Ry.

CHICAGO, ILL.—The North Shore Interurban Ry. Co. has changed its name to the Chicago & Milwaukee Electric Ry. Co., and increased the capital stock from $340,000 to $1,000,000.

ST. PAUL, MINN.—It is reported that Mayor Doran has signed the ordinance granting the St. Paul City Ry. Co., a portion of the Twin City Rapid Transit Co. of Minneapolis, a 41-year franchise to construct an electric street railway through Como Park. Pres., Thomas Lowry.

LITTLE ROCK, ARK.—The Army Post St. Ry. Co. has been incorporated, with a capital stock of $60,000, by M. D. L. Cook, E. Meek, L. W. Cherry, Maxwell Coffin, J. H. Hollis and B. Bodemann.

LOS ANGELES, CAL.—A. B. Patton has been granted a franchise to construct and operate an electric railway from this city to Whittier.——It is reported that George Rheinschild has been awarded a contract for the construction of an extension of the Main & San Pedro St. Electric Ry. from 5th to 30th St.

RIVERSIDE, CAL.—The board of trustees has accepted the bid of Frank A. Miller, Ed. E. Miller and George Frost for a franchise to build an electric railway out 14th St. and down Victoria Ave.

ELECTRIC LIGHT AND POWER.

NEWPORT, ME.—J. N. V. Lane and F. H. Robinson, Bangor, Me., have submitted estimates to this town for a plant. It is proposed to secure power, etc., from the mill of the Newport Woolen Co. About 300 incandescent lights will be required.

TAUNTON, MASS.—Bids are asked until June 5 for furnishing two electric motors, etc., for operating the swing span of the New Bedford & Fairhaven bridge. Engr., Wm. F. Williams, New Bedford; Chn., Edward Mott, Taunton.

WEST MEDWAY, MASS.—At a town meeting held recently it was voted to appropriate $1,250 a year for electric lighting. It is reported that the contract will probably be let to John McGinnis, owner of the plant at Rockland Lake, N. Y., who will furnish about 150 lights. It is likely that the plant at Rockland Lake will be brought to this place. Henry Park, Secy. Com.

WATERBURY, CONN.—Press reports state as follows: Although certain capitalists are said to be willing to invest in the Housatonic electric power scheme, the enterprise has been postponed, owing partly, it is stated, to the failure to secure contracts for electric power in Waterbury, one of the cities which the promoters of the project expected to supply. The plan as laid out a few months ago contemplated a dam over the Housatonic River, a few miles above Derby, from which electric lighting and power were to be supplied to several places in the Naugatuck and Housatonic valleys.

DUNDEE, N. Y.—This place has voted to light the streets all night for $1,600 a year. The contract has been let to a local company.

SYRACUSE, N. Y.—The Syracuse Electric Light & Power Co. has been granted a franchise to construct a subway for its wires. About 75,000 ft. of subway will be built.

HALLSTEAD, PA.—Arthur Squires and N. W. Reynolds, of Tunkhannock, Pa., and Mr. Bernstein, of this place, are considering the question of building a plant to light Hallstead, Montrose, Great Bend and Avoca.

LEHIGHTON, PA.—The council has let a contract to the Fort Electric Corporation, Fort Wayne, Ind., for furnishing and constructing a plant at $18,500. Alex. Bowman, Packerton, Pa., was the next lowest bidder.

PARSONS, PA.—Bids are asked, until June 4, for furnishing 20 arc lights. Geo. W. Wallace, Secy.

FORT WASHINGTON, MD.—It is stated that the lowest bid received by the U. S. engineer for furnishing and installing a plant at this place was informal and new bids have been asked. Estimated cost, $7,500.

SINGERLY, MD.—Press reports state that the reservoir at the Singerly Paper Mills, Singerly, Cecil county, burst May 26 as the result of the heavy rainfall. The water swept into the Little Elk River and broke five smaller dams on its way. Many small structures were washed away. The damage is estimated at about $30,000.

COVINGTON, VA.—The question of granting a franchise for a plant is being considered by the council, according to reports.

PETERSBURG, VA.—The proposed power plant for the Upper Appomattox Co., it is stated, will have a canal, an iron flume about 600 ft. long and 5 ft. in diameter, a water-wheel, etc.

RICHMOND, VA.—The water board has asked for bids for furnishing and installing a plant at the new pumping station.

KERSHAW, S. C.—W. F. Cook, Secy. and Treas., writes us that this town has not yet secured specifications for a plant and water-works, but would like to know the cost of a small plant. Population, 1,600. O. Floyd may be addressed.

ATLANTA, GA.—Bids are asked until June 25 for furnishing and installing a plant at the new county jail. The plant will need a 25-K.-W. generator, engine, foundations, fixtures, etc. Engr., Grant Wilkins, 9½ Peachtree St., Atlanta; Clk., A. L. Kontz.

MACON, GA.—Local papers state that the Macon & Indian Spring Electric St. Ry. Co. will try to purchase the plants of the Macon Gas Light & Water Co. for about $40,000. Should it fail to make the purchase, it is said that a new electric plant will be built at once.

CROWLEY, LA.—Bids are asked until June 7 for furnishing and constructing a plant. It will consist of 6,000 ft. No. 2 three-braid weather-proof line wire; 12,000 ft. No. 5 three-braid weather-proof line wire; 31 sawed cypress poles; 40 cross arms; 80 braces; 80 pins and insulators; 80 lag screws, ½ × 8-in.; 80 ½-in. washers; 120 ½ × 2½-in. lags; 1,000 ft. guy wire; 8 guy slips. Engr., T. W. Kendall; Mayor, J. E. Barry.

MINGO JUNCTION, O.—We are informed that Ezra P. Young, Sewickley, Pa., will own the proposed plant and water-works, for which a franchise was granted to Benj. L. Hirshfield, attorney, 427 Diamond St., Pittsburg, Pa. The Mingo Junction Light & Water Co. has been organized. Bids for the work will probably be opened about June 15.

WELLINGTON, O.—Bids are asked until June 21 for furnishing and installing an electric light plant, as described in our advertising columns. Engr., B. J. Ashley, Old Colony Bldg., Chicago, Ill.; Clk., F. A. Chapman; Mayor, G. L. Couch.

FENTON, MICH.—Press reports state as follows: Clarence Tinker, receiver of the State Bank of Fenton, some time ago sold the electric light plant for $7,000. A number of depositors contested this sale and applied to Judge Wisner for a hearing. Judge Wisner has ordered that the plant be readvertised for sale, the bids to be received until June 29. F. L. Thompson, the first buyer, will fight the action in the courts.

LANSING, MICH.—The commission is reported as considering the question of purchasing an additional engine and dynamo for the plant.

BAYFIELD, WIS.—It is stated that the plant and water-works of this place will be extended. Supt., H. O. Cook.

FOSSTON, MINN.—Bids are asked until June 8 for the purchase of $12,000 of 6% 15-year light and water bonds. N. J. Anderson, Village Recdr.

TWO HARBORS, MINN.—Frank McCormack, Duluth, Minn., is preparing plans for the proposed plant. A 50-arc light and a 1,500-incandescent light dynamo will be put in. W. A. Doerr, Recdr.; J. H. Lunz, Pres.

ELMA, IA.—An election will be held June 10 to vote on the question of issuing bonds for a plant.

KANSAS CITY, KAN.—Local papers state that the triangular tract of land comprising 1½ acres, lying south of the east approach to the James St. bridge, has been bought by the Consolidated Electric Light & Power Co. On this site the company proposes to erect a new electric light plant. Work will be begun on the foundation for the new plant at once and will be pushed until the new power house is completed. According to the plans and specifications the building will be a brick structure, 45 ft. high and 138 × 102 ft.

SEDALIA, MO.—Press reports state as follows: U. S. Marshal W. E. Sterne, Topeka, Kan., on behalf of the estate of the late Judge D. C. Metsker, sold, May 18, to an Eastern syndicate, the Sedalia Electric Ry., Light & Power Co.'s plant for $350,000. The company owns 15 miles of track, one park of 40 acres and another of 120 acres. The lighting plant operates 160 arc and 2,000 incandescent lights. The entire plant will be put in first-class cindition at once. Gen. Mgr., F. W. Child.

WYNNE, ARK.—The council is considering a proposition for the installation of a light plant and water-works. Recorder Eldridge may be addressed.

PONY, MONT.—Elling & Morris are reported to have decided to put in an electric plant at their mill. Work has already been begun. The mill will be operated by electricity.

ANTIOCH, CAL.—Bids are asked until June 5, for the purchase of a franchise for a transmission line in Crockett and Valona. W. C. Meyers, on May 2, applied for such a franchise. F. L. Glass, Clk. Bd. Supervisors.

LOS ANGELES, CAL.—We are informed that the Kern-Rand Co., a corporation with headquarters in the Henne Bldg., Los Angeles, is pushing its field work and making arrangements for contracting power to be delivered through Randsburg and the Rand mining district from its power station on the south fork of Kern River. Some three miles of canal and 40 miles of transmission wire to reach Randsburg, it is hoped, will be ready for contract by Aug. 1. Maj. E. E. Dantforth, Secy., 205 Henne Bldg.

LOS ANGELES, CAL.—It is stated that the Westinghouse Electric & Mfg. Co., Pittsburg, Pa., has been awarded the contract to build and equip the power transmission line for the Pasadena & Southern Light & Power Co., of Los Angeles. The line will be 80 miles in length, and three power stations will be built along its course.

REDLANDS, CAL.—Press reports state that the Redlands Electric Light & Power Co. has engaged F. C. Finkel, San Bernardino, Cal., to complete the survey and estimates for the new electric power development in Mill Creek Canon. This is for the development and diversion of water from the east line of section 9, in Mill Creek Canon, and will require the carrying of water four miles to the present headworks of the company in the canon, and will enable the company to develop 2,500 HP. more than with the present water supply. Another power house will be built. There are a few men working at present, but a large force will be put on as soon as the surveys and estimates are completed.

NEW COMPANIES.—Heckert Light Co., Findlay, O.; $10,000.

United States Power Co., Boston, Mass; $5,000,000, with $50 paid in; Geo. Code, G. J. O'Doherty, R. H. Laidd, Boston; Henry Cummins, 11 Broadway, New York.

Housatonic Power Co., incorporated at Charleston, W. Va.; $3,000,000, with $50 paid in; W. H. Van Steenbergh, 10 Wall St., New York; A. E. Zimmerman, East Orange, N. J.; Richard Schermerhorn, Brooklyn, N. Y.

Lodi Light, Heat & Power Co., Lodi, N. J.; $100,000, with $1,000 paid in; Frank T.Temes, Engr., 714 E. 144th St.; Philip S. Hoffman, of New York.

Clyde Gas & Electric Co., Clyde, N. Y.; $40,000; Lucius L. Moses, Geo. H. Lang, Clyde; Edward Moir, Marcellus, N. Y.

Augusta Electric & Construction Co., Augusta, Ga.; B. R. Mitchell, 212 McIntosh St., Augusta.

Home Electric Co., Brooklyn, N. Y.; $25,000; Walter S. Pierce, 24 West 59th St., and J. W. Thorue, New York; J. W. Mason, Brooklyn.

BRIDGES.

BRATTLEBORO, VT.—Bids are asked by the selectmen until June 11 for constructing a granite arch bridge over Whetstone Brook on Main St.; estimated cost, $15,000. Geo. W. Bond, Consult. Engr., 141 Washington St., Hartford, Conn.

BUFFALO, N. Y.—Plans are being prepared by F. V. E. Bardol, Cy. Engr., for an iron bridge over the Buffalo River at Seneca St.

LONG ISLAND CITY (L. I.), N. Y.—The temporary bridge to be constructed over Newtown Creek at Greenpoint Ave., and for which bids will soon be asked, will have a span of 166 ft. × 32 ft.

HOBOKEN, N. J.—Bids are asked until June 8 for the construction of a bath bridge. M. V. McDermott, Cy. Clk.

JERSEY CITY, N. J.—Bids are asked until June 2 for constructing a new iron bridge over the Morris Canal at Pacific Ave. Edlow W. Harrison, Ch. Engr., Bd. Freeholders, Fuller Bldg.

NEWARK, N. J.—New bids will be asked for constructing two masonry subway bridges in Branch Brook Park, requiring about 1,250 cu. yds. of excavation and 830 cu. yds. of masonry. A. Church, Secy. Essex Park Comn.

PATERSON, N. J.—Bids are asked until June 6 for constructing six iron bridges. Geo. W. Botbyle, County Clk.

TUCKAHOE, N. J.—Bids are asked until June 14 for furnishing plans and specifications for the construction of a 117-ft. span drawbridge over the Tuckahoe River, as stated in our advertising columns. J. C. R. Smith, Clk. Com., Cape May, N. J.

ALLENTOWN, PA.—Bids are asked until June 7 for furnishing plans and constructing a bridge over the Lehigh River on South Second St. Fred. C. Levis, Mayor.

PITTSBURG, PA.—The Thompsons Run Bridge Co. has been incorporated by L. G. Woods, F. M. Ross, T. H. Millholland and C. T. Marsh, Pittsburg, with a capital stock of $5,000.

TOWANDA, PA.—Bids are asked by the county commissioners until June 16 for constructing two steel pony-truss bridges, 45 and 50 ft. long, and one steel substructure. David A. Keefe, Des. Engr., Athens, Pa.

OREGON, MD.—A petition has been presented to the county commissioners for the construction of a bridge over the creek near this place.

CHILLICOTHE, O.—A. W. Jones, County Surv., writes us that bids will soon be asked for constructing a 500-ft. bridge.

CLEVELAND, O.—Bids are asked until June 23 for constructing the substructure and the steel superstructure of the Martin-Phraha bridge across the tracks of the Erie R. R. Co. Geo. R. Warden, Dir. Pub. Wks.

MIDDLETOWN, O.—Bids are asked until June 14 for constructing an iron viaduct and hoist bridge across the canal at Third St., and for the masonry work required. Frank X. Duerr, County Audr.

YOUNGSTOWN, O.—Bids are asked until June 22 for furnishing the material and constructing the masonry substructure and iron superstructure of a bridge over the Mahoning River, on South Ave. Sureties of $4,000 and $10,000 respectively. C. F. Brenner, County Audr.

OWASSO, MICH.—Bids are asked until June 15 for furnishing plans and constructing a 132-ft. truss or deck girder bridge. Riggs & Sherman, Engrs., Toledo, O.

WEST BRANCH, MICH.—W. A. Weeks informs us that a contract was let May 18 for constructing a stone bridge 20 ft. long and 16 ft. wide.

ARGENTA, ILL.—Bids are asked until June 10 for constructing a 100-ft. × 14-ft. highway bridge on stone masonry. Wm. M. Shannon, Town Clk.

CHICAGO, ILL.—The following contracts were awarded last week by the drainage board committee for constructing two railway bridges at Lemont and one highway bridge at Kedzie Ave., respectively: Carnegie Steel Co., Pittsburg, Pa., $76,185; Penn Bridge Co., Beaver Falls, Pa., $26,800; King Bridge Co., Cleveland, O., $21,315.

CHICAGO, ILL.—Bids are asked until July 20 for supplying and constructing 11 bridge superstructures over the Main Drainage channel, as stated in our advertising columns. James Reddick, Clk. Bd. Trustees Sanitary Dist.

DECATUR, ILL.—The Wrought Iron Bridge Co., Canton, O., has been awarded a contract to construct a 100-ft. × 16-ft. bridge on brick substructure.

POLK, IA.—Reports state that the county commissioners will construct a bridge over the Des Moines River, to cost $10,000. The committee consists of Messrs. Fisher, Mathis, and Chaffee.

HARRISONVILLE, MO.—Bids are asked until June 6 for constructing a steel bridge, according to reports. Geo. Bird, County Surv.

KANSAS CITY, MO.—A proposition has been presented to the council to construct a viaduct over the railroad tracks between 23d and Allen Sts., and 19th and Wyoming Sts. The structure would be 1,500 ft. long; estimated cost $33,000.

QUINDARO, KAN.—Reports state that the Kansas City, Northeastern & Gulf Ry. Co. has been authorized to construct a bridge over the Missouri River at this place.

COLFAX, WASH.—Bids are asked until June 7 for constructing five county bridges. John Tobin, County Audr.

ELBE, WASH.—It has been proposed to construct a bridge over the Marshall River to cost about $4,500.

NOVELTY, WASH.—A petition has been presented to the county commissioners for the construction of a bridge over the Snoqualmie River.

POST FALLS, WASH.—A contract has been awarded to Oliver Bros., Spokane, at $2,300 for constructing a county bridge over the Spokane River.

SPOKANE, WASH.—Reports state that a bridge is to be constructed across the Spokane River to carry the water-works mains, at a cost of about $9,000.

ROSEBURG, ORE.—Bids are asked until July 8 for constructing a bridge over Elk Creek. A. F. Stearns, County Judge.

PHOENIX, ARIZ.—It is reported that the Southern Pacific Co. will construct a new steel bridge across the Colorado River, this summer, to have one span of 200 ft. and two spans of 160 ft., on masonry piers.

BUILDINGS.

KNIGHTSVILLE, ME.—Bids are asked until June 4 for erecting a 3-story brick building for the Hiram Lodge. F. & A. M. Archs., F. H. & E. F. Fassett, Centennial Block, Portland, Me.

BURLINGTON, VT.—Plans have been prepared, according to reports, for a 3-story brick and granite theatre building to be erected in this city at a cost of about $50,000. Archs., H. W. Phillips & Co., 42 State St., Rochester, N. Y.

BROOKLYN, N. Y.—Bids are asked by the school board of the borough of Brooklyn, 131 Livingston St., until June 7, for making alterations and repairs, etc., to various public school buildings. John McNamee, Chn. Com. on Bldgs.

JOHNSTOWN, N. Y.—Bids are asked, until June 6, for the erection of a union free school building, to cost about $25,000. J. L. Way, Chn. Bldg. Com.; G. W. Fuller, Arch., Albany, N. Y.

NEW YORK, N. Y.—It is reported that W. E. Thompson has been awarded the carpentry contract and McEntee & O'Brien the masonry contract for a new 6-story business building to be erected on 34th St. Arch., Geo. H. Van Auken, 32 East 14th St.——The general contract for erecting a 7-story apartment building on 106th St., near the Boulevard, for Louis F. Weisman, has been let to Robinson & Wallace, 123 East 23d St. Arch., John A. Hamilton, 32 Broadway.——Bids will soon be asked, according to reports, for erecting a new 2½-story stone library building for the Aguilar Free Library Association, on 110th St., west of Third Ave., to cost about $35,000. Archs., Herts & Tallant, 481 Fifth Ave.; Mark Ash, Chn. Bldg. Com., 11 Broadway.——Plans have been filed by Henry Miller, 701 East 138th St., for three 5-story brick flat buildings, on 138th St., near Alexander Ave., to cost $75,000. Arch., H. T. Howell, 748 East 138th St.; by James Levin, for four 4-story brick flat buildings on Washington Ave., near 165th St., to cost $60,000. Arch., W. C. Dickerson, 3d Ave. and 149th St.; by H. W. Powell, 424 West 124th St., for eight 4-story brick dwellings on 144th St., near Convent Ave., to cost $104,000. Arch., Thos. H. Dunn, 401 West 141st St.; by Manhattan Improvement Co., for four 5-story brick flat buildings on 139th St., near St. Ann's Ave., to cost $101,000. Arch., J. A. Burner; by Isaac L. Smith, 59 Liberty St., for a 6-story brick flat building, at 40 West 128th St., to cost $60,000. Arch., R. R. Davis. 247 West 125th St.; by William C. Oesting, 342 St. Ann's Ave., for eleven 5-story brick flat buildings at 140th St.

and St. Ann's Ave., to cost $301,000. Arch., Harry T. Howell, 748 East 138th St.; by J. A. Chandler, 120 Broadway, for a 10-story brick store and loft building at 298 and 300 Broadway, to cost $110,000. Archs., McKim, Mead & White, 160 5th Ave.

SYRACUSE, N. Y.—Plans and specifications are asked, until August 1, according to reports, for five buildings. Ray B. Smith, Chn. Bd. Supervisors.

TROY, N. Y.—Bids are asked, until June 7 for the erection of a new granite church building, 129 × 95 ft., to be erected in this city for St. Mary's Parish; reported cost, $125,000. Pastor, John F. Lowery; Archs., M. F. Cummings & Son.

WEST TROY, N. Y.—The Northcote Warming & Ventilating Co., Elmira, N. Y., has been awarded the contract for heating and ventilating the two new school buildings, and the addition to School No. 1, in Watervliet, at $5,059.

JERSEY CITY, N. J.—Alexander Hammil, Montgomery St., is said to have received the iron contract for the new theatre and gymnasium building to be erected on York St., at a cost of $50,000, for St. Joseph's Lyceum. Arch., Herman Heitler, 62 Broad St., New York.

PHILADELPHIA, PA.—David R. Burns, 739 North 19th St., Philadelphia, was awarded the contract, May 23, for heating and ventilating a portion of the county prison, at $17,025. Supt., R. C. Motherwell, Jr.——The contract for erecting the new 8-story addition for the Philadelphia Warehousing & Cold Storage Co., at Noble St. and Delaware Ave., has been let to J. E. & A. L. Pennock, of this city.

PITTSBURG, PA.—The warehouse of Henderson & Johnson, on Carson St., containing hay, grain, etc., was destroyed by fire, May 29, causing a total loss of about $125,000.——The following bids have been received by the department of public works for alteration of council chambers: A. & S. Wilson, $10,362, with mosaic floors, $3,227 extra; Wilson & Sons, $10,900, and with mosaic floors, $2,700; William H. Hoffman, with mosaic floors, $10,948, and without, $7,648; Henry Schenk, $11,352, and with mosaic floors, $2,876 extra. For elevators: Sprague Electrical Co., $3,675; Otis Elevator Co., $5,280.

BALTIMORE, MD.—The car barn of the Consolidated Ry. Co., and 130 winter cars, were burned, May 29, causing a loss of about $250,000; fully insured. The building was of brick and iron, 75 × 300 ft., and was supposed to have been fireproof. Wm. A. House, Gen. Mgr.

KANAWHA CITY, W. VA.—Bids are asked until June 13 for building houses for lock hands on Kanawha River. Addison M. Scott, Resident Engr.

MONTGOMERY, ALA.—We are informed that the new building which the Knoxville Bldg. & Construction Co., Knoxville, Tenn., will build in this city for Griel Bros. & Co., will have three stories and a basement, 150 × 200 ft., and will cost $41,800. Archs., Lockwood & Smith, Montgomery.

CLEVELAND, O.—Bids are asked by the board of education, 190 Euclid Ave., until June 25 for erecting the new Woodland Hills school building. H. Q. Sargent, School Director.

COLUMBUS, O.—Richards & McCarty have been selected as architects for the new school building to be erected for the Deaf and Dumb Asylum, to cost about $60,000.

DAYTON, O.—Bids are asked by the trustees of Dayton State Hospital until June 16 for the installation of an ice and refrigerating plant for said hospital. Secy., J. M. Ratcliff; Archs., Williams & Andrews, Dayton.

GLENVILLE, O.—Bids are asked by the board of education, until June 20, for erecting an 8-room brick school building on Parkwood Ave. Address Wm. J. Boyd, Clk., 9 Ludwig St., Glenville; Morris M. Gleichman, 89 Euclid Ave., Cleveland, O.

LUDLOW FALLS, O.—Bids are asked, until June 11, for erecting a new school building for Union township. Clk., Clark Coate.

MASSILLON, O.—Bids are asked by the trustees of the Massillon State Hospital, at the office of Yost & Packard Archs., Y. M. C. A. Bldg., Columbus, O., until June 23 for the erection and completion of Cottages C, D, E, F, G and H, and for an office building and superintendent's residence. Secy., A. B. Richardson.

SANDUSKY, O.—Bids are asked by the trustees of the Ohio Soldiers' and Sailors' Home, until June 21, for constructing one ward and necessary corridor connections of the new hospital building. Quartermaster, D. Dugan; Arch., H. C. Lindsay, Zanesville, O.

WAPAKONETA, O.—Bids are asked, until June 13, for the erection of a new school building. T. W. Blackburn, Clk. Bd. of Education.

ZANESVILLE, O.—Bids are asked, until June 30, for erecting an addition to the school building, and for installing a heating apparatus therein. C. O. Marshall, Township Clk.

HILLSDALE, MICH.—We are informed that bids will be received, June 17, and the contract awarded June 20, for the construction of a new brick and stone court house, estimated to cost $45,000. The estimated cost of equipment is $3,000, and one or two tubular boilers will be needed for heating purposes. Arch., Claire Allen, Jackson, Mich.

CHICAGO, ILL.—Bids are asked by the department of public works, until June 7, for completing the changes in the Carter H. Harrison public bath-house, at 192 Mather St. Comr., L. E. McGann.

PEORIA, ILL.—The following bids were received, May 25, for erecting the five main buildings of the asylum for the incurable insane: Gleason & Son, Chicago, $179,976; Valentine Jobst, Peoria, $212,696; Warren Roberts & Co., Chicago, $229,800; William M. Allen, Peoria, $239,793; Charles Moses, Chicago, $243,310; W. F. Hoyle, Lincoln, Ill., $291,843.

MILWAUKEE, WIS.—The masonry contract for the new administration building of the Milwaukee-Downer College, on Glen Ave., has been let to Patrick Dunn, of Milwaukee, and the contract for the new dormitory let to Peters & Gruenwald, also of this city. Estimated cost of both buildings, $105,000.

WEST SUPERIOR, WIS.—Harry Downs & Son, of Minneapolis, Minn., have been awarded the general contract for the erection of a 2-story brick warehouse, 40 × 100 ft., for the Eastern Minnesota Ry. Co., to cost about $20,000.

ABERCROMBIE, N. DAK.—Bids are asked, until June 10, for erecting an elevator and warehouse for A. W. Tweto, Abercrombie.

KANSAS CITY, MO.—Bids are asked, until June 29, for work in the post office building, as stated in our advertising columns. John Knox Taylor, Supervising Arch., Washington, D. C.

SAVANNAH, MO.—Bids are asked, until June 17, for erecting a 2-story fireproof court house, estimated to cost $40,000. County Clk., T. S. Reed; Arch., Geo. E. McDonald, Savannah.

DALLAS, TEX.—A fire in this city, May 27, destroyed the 2-story brick building occupied by the J. F. Barry furniture establishment and adjoining buildings, causing a reported loss of $300,000.

EL PASO, TEX.—B. S. Cattin, Cy. Clk., writes us that no action will be taken with reference to preparing plans for a new city hall building until bonds are sold for erecting the same. Time for selling bonds has not yet been fixed.

WHARTON, TEX.—Bids are asked until June 13 for repairs to the Wharton county court house. J. G. Barbee, County Judge; C. A. Caughlin, Arch.

HOLBROOK, ARIZ.—Kennedy & Grim, Flagstaff, Ariz., have been awarded the contract for building the new court house, at $12,000.

PHOENIX, ARIZ.—Plans and specifications are asked, until July 20, for a new capitol building for the territory of Arizona, to be erected in this city. Pres., I. N. Bell.

SAN DIEGO, CAL.—Bids are asked by the trustees of the State Normal School of San Diego, until June 24, for erecting the central portion of the proposed school building. Pres., W. R. Guy; Archs., Hebbard & Gill, Grant Bldg., San Diego.

MONTREAL, QUE.—Plans are being prepared for the West End Theatre Co., according to report, for a 3-story brick and terra cotta theatre building, 80 × 175 ft., to cost about $100,000. Archs., J. B. McElfatrick & Son, 1402 Broadway, New York.

WINNIPEG, MAN.—Bids are requested on building materials, etc., required in the erection of a new 5-story building, 174 × 92 ft., to replace the old one lately destroyed by fire. Jas. H. Cadham, Builder and Contractor, Winnipeg.

GLASGOW, SCOTLAND.—Designs are asked by the building committee of the Glasgow International Exhibition, 1901, until August 15, for the exhibition buildings to be erected in Kelvingrove Park and Bunhouse Ground, covering in all a space of about 13 acres. Total estimated cost, £60,000 ($300,000). H. A. Hedley, Gen. Mgr. and Secy., 141 Buchanan St., Glasgow.

WATER-WORKS.

PORTSMOUTH, N. H.—Frank Jones has petitioned the water commissioners to extend the mains to the Hotel Wentworth.

BARRE, VT.—Reports state that the council and the Barre Water Co. have reached an agrement whereby the works will be purchased by the city.

NORTH AMHERST, MASS.—F. P. Ainsworth writes us that there is no prospect of anything being done at present in regard to the proposed supply from Atkins Pond, noted in our issue of May 5. The plan is too large financially for this small place.

BOLIVAR, N. Y.—This place is said to have granted a franchise for works to cost about $16,000. The source of supply will be springs located about three miles distant. J. B. Beadley may be addressed.

CARBONDALE, PA.—The city clerk is asking for bids for furnishing eight new fire hydrants, accord ng to reports.

JOHNSTOWN, PA.—A. H. Walters, Supt. Johnstown Water Co. writes us that the new reservoir of about 50,000,000 gallons capacity, will be located on Mill Creek, above the present reservoir. The work will be carried on by the company.

MATAMORAS, PA.—The Matamoras Water Co. has been incorporated with a capital stock of $7,000 by H. O. Rosenkrans, A. T. Porter, W. E. Scott, Treas.; and R. G. Thorpe, Port Jervis, N. Y.; A. W. Balch, C. A. Snyder and W. H. French, Matamoras.

NORWOOD, PA.—Bids are asked until June 9 for sinking an 8 or 10-in. artesian well, as stated in our advertising columns. C. H. Bond, Clk.

PHILADELPHIA, PA.—The select council has agreed to a resolution introduced by Mr. Joerger to place a filter apparatus in every school building in the city.

WASHINGTON, D. C.—Bids are asked by the district commissioners until June 13 for furnishing cast-iron water pipe, as stated in our advertising columns.

FAIRMONT, W. VA.—J. Harry Meredith, Recdr., writes us that the city will lay some water mains. J. M. Pricket, Cy. Engr.

PARKERSBURG, W. VA.—R. H. Thomas, Mayor, writes us that this city proposes to lay from 500 to 700 ft. of 3-ft. cast-iron water pipe in the river from a pumping station. It is also proposed to lay 14-in. pipe from another pumping station.

KERSHAW, S. C.—W. F. Cook Secy. and Treas., writes us that no specifications for works and light plant have yet been prepared; the town would like to secure the cost of such improvements, however. There would be needed a stand-pipe of about 50,000 gallons capacity, 4 or 6-in. mains and 10 or 12 hydrants. Population, 1,500. O. Floyd may be addressed.

CROWLEY, LA.—Bids are asked, until June 7 for furnishing and constructing an extension to the works. There will be required 97 tons of 4 and 6-in. pipe, 8 double nozzle Corey hydrants, three 6-in. gate valves, 1,500 lbs. of special castings, 4,000 lbs. of pipe lead, etc. J. E. Barry, Mayor.

GALLATIN, TENN.—An election will be held June 4 to vote on the question of issuing $25,000 in bonds for works. W. L. Oldham, Mayor.

CLEVELAND, O.—Bids are asked until June 13 for furnishing such cast-iron water pipe as may be required by the water department during the year. (Postponed from June 10.) Geo. R. Warden, Dir. Pub. Wks.

COLUMBUS, O.—The water committee of the council is considering the question of extending the mains to the Capital University. It will require the water to be carried across Alum Creek.

LANCASTER, O.—C. D. Hilles, Secy. Bd. Managers, Boys' Industrial School, writes us that plans for works and a sewerage system for the schools have been adopted, and bids for the same will be received during the next 30 days.

MINGO JUNCTION, O.—We are informed that Ezra P. Young, Sewickley, Pa., is the owner of the franchise recently granted for works and a light plant, noted in our issue of last week. Bids will probably be received up to about June 15. The Mingo Junction Light & Water Co. has been organized.

NORWALK, O.—L. E. Chapin, Canton, O., is preparing plans for a stand-pipe for this place.

WELLINGTON, O.—Bids are asked until June 22 for furnishing and constructing works, as described in our advertising columns. Engr., B. J. Ashley, Chicago; Clk., F. A. Chapman.

WASHINGTON, IND.—It is stated that the plant of the Washington Water-Works Co. was sold at sheriff's sale, May 24, for $10,000. It was bonded for $160,000. The purchasers were W. B. Hurd, of New York, and Theodore Woodbury, of Portland, Me.

WHITING, IND.—J. G. Erdlitz, Water Clk., writes us that there will be only a few hundred feet of extensions to the water mains this year. Wm. Curtis and E. O'Hara are on the committee.

DELRAY, MICH.—This place voted May 23 to issue $50,000 in bonds for extending the water-works of Detroit to here for a water supply. There will be required about 11 miles of pipe. Dr. Clippert, Pres. Village.

CHICAGO, ILL.—Bids are asked until June 4 for teaming and hauling water pipe for the term ending May 31; check, $1,000. L. E. McGann, Comr. Pub. Wks.

CHICAGO, ILL.—Bids are asked until June 8 for laying water pipe in a number of streets. L. E. McGann, Pres. Bd. Local Improvements.

EDWARDSVILLE, ILL.—M. T. Lewman & Co., Louisville, Ky., are reported to have been awarded the contract for building the works for the Edwardsville Water Co., at about $65,000.

KEWANEE, ILL.—John C. Quade, Cy. Engr., writes us that the contract for furnishing 4,400 ft. of 6-in. water pipe, etc., will be let the latter part of this month; estimated cost, $2,800.

JUNEAU, WIS.—It is stated that D. Ahearn & Son, Fond du Lac, Wis., have been awarded the contract for extending the works, at $2,468.

LANESBORO, MINN.—An election will soon be held to vote on the question of issuing bonds for extending the works. Population (1890), 898. O. M. Habberstad may be addressed.

MORA, MINN.—The council has been asked to call an election to vote on the question of issuing bonds for works. A. J. Conger may be addressed.

TWO HARBORS, MINN.—It is proposed to purchase a new pump for the water-works, according to reports. Supt., John Dwan.

ULEN, MINN.—This place proposes to build works, according to reports.

WEST CONCORD, MINN.—This place will soon hold an election to vote on the question of issuing $5,000 in bonds for the proposed works.

NEODESHA, KAN.—Bids will be opened June 7 for building works to cost about $15,000. J. B. Gauder, Alderman, writes us that estimates have been mailed to jobbers and manufacturers. Population, 2,200. Engr., F. H. Stocking.

BERESFORD, S. DAK.—An election will be held June 6 to vote on the question of issuing $4,400 in bonds for the proposed works.

YANKTON, S. DAK.—Bids are asked until June 20 for building a 20 × 30 ft. water tank. L. M. Yeatman, Cy. Clk.

CASSELTON, N. DAK.—Bids are asked, until June 6 for sinking an artesian well, according to reports. L. C. Carver, City Audr.

BETHANY, MO.—We are informed that the proposed extension to the works will require cast-iron pipe, a filter, etc. No contract has yet been let. The construction will probably be carried on by the city. The source of supply will be about 1,495 ft. from the pumping station. Engr., W. Kierstead, 58 Water-Works Bldg., Kansas City, Mo.; Chn. Com., J. W. Kenyon.

KANSAS CITY, MO.—Bids are asked, until June 7 for furnishing from 200 to 500 tons of 6-in. cast-iron water pipe and also a carload of 4-in. pipe, as stated in our advertising columns. R. M. Godfrey, Secy. Water Bd.

ST. JOSEPH, MO.—The council is considering the question of setting aside $2,500 for the use of the committee to investigate the question of the municipal ownership of the water-works. Alderman Kuehl may be addressed.

WYNNE, ARK.—The council is reported as considering the question of granting franchises for works and a light plant. Recorder Eldridge may be addressed.

BOULDER, COLO.—The council is reported to have decided to build a pumping station and lay 4-in. mains for furnishing a water supply from the reservoir on the Chautauqua grounds.

MONROVIA, CAL.—Bids are asked until June 18 for the purchase of $25,000 of water-works bonds, voted May 14. We are informed that bids will also soon be asked for furnishing a plant to pump water from well, also for a duplex pump to force water through 12-in. pipe to an elevation of 150 ft. Des. Engr., R. A. Sawyer, Byrne Bldg., Los Angeles, Cal.; Cy. Clk., W. A. Walker.

FLAGSTAFF, ARIZ.—It is stated that contracts for building the proposed works have been let to the American Asphalt Co., Los Angeles, Cal., and to Goodhue & Hinckley, at $65,000. Further information can be found in our issue of last week. C. H. Edwards, Town Clk.

KENDRICK, IDAHO.—It is stated that Orchard, Wolf & Zimmerman have been granted a 30-year franchise for works. Work will begin at once.

BERLIN, ONT.—The town is reported to have voted to purchase the works built in 1888 by Moffett, Hodgkins & Clarke, of Syracuse, N. Y.

ROSSLAND, B. C.—Press reports state that H. S. Follows, Gen. Mgr. Rossland Water & Light Co., will extend the works, etc.

WINNIPEG, MAN.—Bids are asked until July 25 for furnishing the materials and for constructing wells and a pumping plant of 4,000,000 gallons capacity, as stated in our advertising columns. C. J. Brown, Cy. Clk.

COOLGARDIE, WEST AUSTRALIA.—Bids are asked until Aug. 23 for furnishing 246 miles of 31-in. riveted steel pipe, 82 miles of from 26 to 29-in. welded steel pipe, etc., for the proposed works for this city. A description of the proposed water supply was given in Engineering News of Feb. 10. Form of bid, with drawings, specifications, etc., annexed, may be obtained on payment of a fee of two guineas ($10), in Europe, at the office of the Agent-General for Western Australia, 15 Victoria St., Westminster, London, S. W.; in America, at the office of Seward, Guthrie & Steele, 40 Wall St., New York, and in Western Australia, at the office of the Honorable the Director of Public Works, Perth. C. Y. O'Connor, Engr.-in-Chief, Perth, Western Australia.

SEWERAGE.

CONCORD, MASS.—Bids are asked until June 22 for constructing a system, as described in our advertising columns. Engr., Leonard Metcalf, 89 State St., Boston; Chn. Com., Wm. Wheeler.

MARLBORO, MASS.—It is proposed to construct sewers in Beach St. and the Lake William district, at a cost of $20,000.

SPRINGFIELD, MASS.—Bids are asked until June 14 for constructing brick sewers, as described in our advertising columns. C. M. Slocum, Cy. Engr.; W. L. Dickinson, Supt. of Sts.; D. O. Gilmore, Chn. Com.

BRISTOL, CONN.—D. J. Hefferman, Borough Clk., writes us that this place does not expect to build any sewer extensions this year unless something might be ordered later in the year. Perhaps one sewage disposal bed may be built by the town.

NEW HAVEN, CONN.—Bids are asked until June 6 for constructing sewers in a number of streets. C. W. Kelly, Cy. Engr.

LANCASTER, N. Y.—Geo. Bingham, Chn. Com., writes us that this city is about to ask for bids for survey, maps, plans, etc., for the proposed system.

LYONS, N. Y.—Lincoln Bishop, Surv., writes us that no work is likely to be done this year on the proposed system, estimates, etc., for which were prepared last year by Potter & Folwell, New York; estimated cost, $50,000.

NEW ROCHELLE, N. Y.—It is stated that the following contracts were let May 31 for building the new system of outlet sewers in Hudson Park, as advertised in Engineering News: The section of 800 ft. passing under the park to the water line was let to Peter Sweeney, of Danbury, Conn., at $14,623, and the submerged pipe into Echo Bay to Michael J. Dady, of Brooklyn, at $47,670. The new sewer will discharge about 3,000 ft. from Hudson Park, a distance sufficient to reach the main channel of Long Island Sound. Work will be begun in about a week, and it is expected that the improvement will be completed within six months.

NORTH TARRYTOWN, N. Y.—Bids are asked until June 16 for furnishing and constructing about four miles of sewers, as stated in our advertising columns. Engr., W. E. Crane; Clk., David Silver.

ROCHESTER, N. Y.—Bids are asked until June 7 for constructing pipe sewers in two streets, etc. Chas. M. Beattie, Clk. Executive Bd.

SING SING, N. Y.—Bids are asked until June 7 for extending the Main St. trunk sewer. J. M. Terwilliger, Clk.; Wm. Brandreth, Pres.

ELIZABETH, N. J.—Bids are asked until June 15 for constructing about 5,600 ft. of 15 and 12-in. pipe sewers, 50 manholes, 10 catchbasins, etc. N. K. Thompson, St. Comr. The property owners on the north side are urging the construction of sewers.

RAHWAY, N. J.—Bids are asked until June 14 for constructing 2,500 ft. of 12 and 8-in. pipe sewers. We are informed that the contract has been let and the work commenced on the construction of 1,700 ft. of 45 × 30-in. brick and 1,700 ft. of 15-in. pipe sewers. W. E. Clark, Cy. Engr.

CAMBRIDGE SPRINGS, PA.—Bids are asked until June 17 for furnishing and laying a pipe sewer in Main St. Geo. L. Wade, Clk.

DARBY, PA.—Bids are asked until June 6 for constructing sewers in Main and 12th Sts. Engrs., Harris & Damon, 864 Main St., Darby; Chn. Com., C. E. Drewers.

LEBANON, PA.—Press reports state that at a meeting of the board of managers of the Pennsylvania Chautauqua at Lebanon, May 26, plans for the system to be erected on the Chautauqua grounds at Mount Gretna were adopted. They were drawn by J. H. Fuertes, 100 William St., New York, and include sand filtration.

PARKERSBURG, W. VA.—R. H. Thomas, Mayor, writes us that it is proposed to lay about 2,000 ft. of sewers, specifications for which are being prepared.

ATLANTA, GA.—It is proposed to construct pipe sewers in several streets at a cost of about $15,000. W. D. Greene, Cy. Clk.

MACON, GA.—A. T. Holt, Macon, writes us that nothing definite has yet been decided in regard to the proposed sewers for Vineville.

LEXINGTON, KY.—The council has granted the Eastern Kentucky Asylum for the Insane permission to construct sewers in certain streets in the vicinity of the institution. Mayor, J. B. Simrol.

COLUMBUS, O.—John W. Alvord, The Rookery, Chicago, Ill., and Julian Griggs, Ch. Engr., have submitted to F. A. Jacobs, Dir. Pub. Works, their report on the proposed improvements to the system. It is recommended that a disposal plant to cost about $500,000 be built, and also a complete system on the west side with pumping station.

GREENVILLE, O.—We are informed that this place will vote, June 20, on the question of building sewers; population, 6,000. A. C. Robeson, Pres. Trustees; J. C. Weaver, Vice-Pres. Engr., John Beers.

LANCASTER, O.—C. D. Hiles, Secy. Trustees Boys' Industrial School, writes us that plans for a new system and a sewage disposal plant, etc., have been adopted, and bids will be received for the work within the next 30 days.

LOCKLAND, O.—G. W. Davis, Mayor, writes us that there have been no plans prepared as yet for the proposed system. Engr., James Cooper, Reading, O.

TOLEDO, O.—Bids are asked until June 13 for constructing 15 to 10-in. pipe sewers in several streets. L. P. Harris, Cy. Clk.

DECATUR, IND.—Bids are asked until June 7 for constructing pipe sewers in two streets. J. W. Tyndall, Cy. Engr.

SOUTH BEND, IND.—Bids are asked until June 27 for constructing a pipe sewer in Sample St. L. A. Hull Cy. Clk.

LAPEER, MICH.—Bids are asked until June 13 for constructing sewers in Calhoun St. J. H. Taylor, Chn. Com.

OWOSSO, MICH.—The council of West Owosso will be ready in about a week to ask for bids for constructing sewers. Engrs, Riggs & Sherman, The Nasby, Toledo, O.

KEWANEE, ILL.—We are informed that the contract for constructing about seven miles of 18 to 8-in. pipe sewers will be let early in July; average cut 10 to 12 ft.; estimated cost, $30,000. John C. Quade, Cy. Engr.

PONTIAC, ILL.—Bids are asked until June 13 for constructing 5,240 ft. of pipe sewers, as described in our advertising columns. D. S. Myers, Chn. Com.

BARABOO, WIS.—Bids are asked until June 9 for constructing 1,200 ft. of 8-in. pipe sewer. Another 12-in. sewer 900 ft. long is proposed. W. G. Kirchoffer, Cy. Engr.

WAUPACA, WIS.—C. J. Ellis writes us that only a survey has been made for the proposed system. Engr., G. Steinhagen, 44 Mack Block, Milwaukee, Wis.

CEDAR RAPIDS, IA.—Bids are asked until June 10 for furnishing the material and for building a storm sewer in 3d St. J. D. Blain, Recdr.

IOWA CITY, IA.—Bids are asked until June 10 for furnishing and constructing 30 ft. of 22 × 33-in. single-ring 1,100 ft. of 32 × 48-in. two-ring and 270 ft. of 42-in. two-ring brick sewer, 7 catchbasins, etc. Cy. Engr., A. J. Cox; Cy. Clk., W. J. Bowen.

NEW HAMPTON, IA.—Boynton & Warriner, Cedar Rapids, Ia., are reported as preparing plans for a small system for this place.

TWO HARBORS, MINN.—It is proposed to build new sewers in Second and Fourth Sts.

INDEPENDENCE, KAN.—We are informed that this place will build a system. John M. Walker, Cy. Engr.

KANSAS CITY, MO.—Local papers state as follows: A plan to do away with the O. K. Creek sewer nuisance will probably be adopted by the council soon. This is to extend the intercepting sewer, which drains about two-fifths of the city, from the point where it at present joins Turkey Creek, 25th and Fairmount Aves., three-quarters of a mile to the bridges of the Santa Fe, the Memphis and the Burlington railways. It is understood if this is done the railways and the stockyards companies will extend the sewer on to the Kaw. This disposition of the O. K. Creek trouble will cost the city only $25,000. Alderman Beroth will introduce an ordinance for the work of abating this nuisance of long standing.

ST. LOUIS, MO.—Bids are asked until June 10 for repairing sewers, inlets, etc., as may be directed by the sewer commissioner for one year from July 1. Robt. E. McMath, Pres. Bd. Pub. Improvements.

SHERMAN, TEX.—It is proposed to issue $20,000 in bonds for extending the sewers. J. C. Edmunds, Mayor.

SACRAMENTO, CAL.—Wm. Mullenney, Cy. Surv., has again been directed to prepare plans for a sewerage system. We are informed that the committee consists of Aldermen Kent, Chn., Brown and Paine; Cy. Clk., M. J. Desmond.

PALO ALTO, CAL.—We are informed that this place is asking for bids for constructing sewers; estimated cost, about $20,000. Engr., C. E. Moore, Santa Clara, Cal.

GARBAGE DISPOSAL—STREET CLEANING

HARTFORD, CONN.—The street board is reported as considering bids for removing the ashes, garbage, etc., of the city. Commissioner Butts may be addressed.

BUFFALO, N. Y.—Local papers state as follows: Contracts for cleaning city streets will expire Aug. 1. The present contractors are John Martin & Co., Nachtrieb, Beyer & Meyer and Cooper & Hopkins. Their contracts expire on the same day and Supt. Shifferens, of the Bureau of Streets, is preparing specifications for new bids, which will be called for in a short time. The contracts in the past have been for three years, the contractors bidding on districts. This plan is to be continued. The city pays about $120,000 a year for this work.

POUGHKEEPSIE, N. Y.—Bids are asked until June 6 for removing the swill and garbage from the streets for the six months ending Jan. 1. A. H. Vail, Cy. Chamberlain.

STREETS AND ROADS.

BANGOR, ME.—Bids are asked until June 3 for paving Railroad St. Fred. S. Porter, Chn. Bd. St. Engrs.

CAMBRIDGE, MASS.—The street committee has ordered brick sidewalks to be constructed in portions of 10 streets and the laying of edgestones in portions of 12 streets.

HOLYOKE, MASS.—Bids are asked until June 10 for 6,000 sq. yds. of brick paving, as stated in our advertising columns. M. F. Walsh, Chn. Bd. Pub. Wks.

LOWELL, MASS.—A petition has been presented to the county commissioners to have the state highway commission construct a road from Lowell to Lawrence.

MILTON, MASS.—A contract has been awarded to W. H. Magne, West Newton, at $71,000, for widening certain streets.

PITTSFIELD, MASS.—The board of public works has ordered the construction of concrete sidewalks in five streets.

NORTH ADAMS, MASS.—The council has voted to pave five streets with brick and will borrow $25,000 for that purpose.

LEE, MASS.—A contract has been awarded to Shute & Rightouyer, Hudson, N. Y., for constructing 3,800 ft. of macadam road. Wm. H. Barnes, Engr.

GRANBY, CONN.—Bids are asked until June 7 for constructing a gravel road in East Granby. Geo. E. Bidwell, First Selectman.

ROCKYHILL, CONN.—Bids are asked until June 10 for constructing a macadam road. Owen R. Havens, First Selectman.

SOUTHINGTON, CONN.—Bids are asked until June 6 for grading and macadamizing sections of roads. A. M. Lewis, First Selectman.

CANAAN, CONN.—Bids are asked until June 8 for improving the Bennett Hill Crossing Road, in North Canaan. J. N. Van Deusen, First Selectman.

WETHERSFIELD, CONN.—Bids are asked until June 4 for constructing a telford road. J. G. Adams, First Selectman.

WESTPORT, CONN.—Bids are asked until June 4 for constructing a telford road. L. P. Wakeman, First Selectman.

EAST HAMPTON, CONN.—Bids are asked until June 6 for grading and macadamizing in Main St. C. G. Bevin, First Selectman.

EAST HADDAM, CONN.—Bids are asked until June 11 for grading and macadamizing a section of road. Sidney S. Carter, First Selectman.

KILLINGLY, CONN.—Bids are asked until June 7 for building a macadam road about 3,000 ft. long. O. W. Bowen, First Selectman, Danielson.

NEW HAVEN, CONN.—Bids are asked until June 9 for macadamizing on the Litchfield turnpike at Woodbridge. Rolin C. Newton, First Selectman; A. B. Hill, Engr., 82 Church St., New Haven.

GLENS FALLS, N. Y.—Geo. P. Slade, Cy. Engr., has been authorized to make plans for about 5,000 sq. yds. of brick paving. Wm. H. Haskell, Pres.

NEW YORK, N. Y.—Bids are asked until June 7 for furnishing and delivering broken stone, screenings and limestone in the Borough of Bronx. James P. Keating, Comr. Highways, 150 Nassau St.—Bids are asked until June 9 for constructing walks, roadway, steps, drains, etc., in Riverside Park, between 79th St. and 120th St. Geo. C. Clausen, Comr. Parks, Arsenal Bldg., Central Park.

PORT CHESTER, N. Y.—The trustees have decided to pave Main St. and a part of Westchester Ave.; estimated cost, $40,000.

ROCHESTER, N. Y.—Ordinances have been adopted for paving in the following streets: East Main St., brick, $74,700, asphalt, $77,000; Parsells Ave., asphalt, $31,000, Pierpont Ave., asphalt, $26,000; Lynden and Yale Sts. asphalt paving and cement sidewalks in Yale St., $21,200; Post St., macadam, $7,550; Elizabeth St., Medina block, $3,050. Edwin A. Fisher, Cy. Engr.

TROY, N. Y.—Bids are asked until June 7 for paving in North St. and Middleburg St. with brick. E. Ogden Ross, Secy.

TROY, N. Y.—Bids are asked until June 3 for paving Adams St. with brick between River St. and Second St., and until June 10 for brick paving in 10th St. and Hoosick St. E. Ogden Ross, Secy. Contracting Bd.

UTICA, N. Y.—Bids are asked until June [illegible] for repairing asphalt pavement in Whitesboro St. and Columbia St. J. A. Cantwell, Cy. Clk.

ELIZABETH, N. J.—Bids are asked until June 15 for 1,700 cu. yds. of excavation, 1,616 ft. of curb and 1,616 lin. ft. of 4-ft. flag. N. K. Thompson, St. Comr.

FREEHOLD, N. J.—Bids are asked until [illegible] for constructing a road of iron ore and gravel in [illegible] ship. J. D. Honce, County Clk.

MORRISTOWN, N. J.—Bids are asked until June 20 for macadamizing a portion of the Basking Ridge Road. Merritt B. Lum, Dir. Bd. Freeholders.

ROSELLE, N. J.—Bids are asked until June 3 for a certain amount of street work, as described in our advertising columns. Clk., G. A. Rawlins.

WASHINGTON, D. C.—Bids are asked until June 11 for improving portions of South Capitol St., [illegible] St. and 20th St., and for furnishing broken stone for [illegible] 25th St. John W. Ross, Comr.

MONTGOMERY, ALA.—Bids are asked until June 6 for brick paving and constructing sidewalks in [illegible] from Clayton St. to Mildred St. R. H. Sommerville, Texas.

NASHVILLE, TENN.—Bids are asked until June 2 for brick and granite paving on the public square. Wm. W. Southgate, Cy. Engr.

LOUISVILLE, KY.—Bids are asked by the board of public works until June 6 for brick or asphalt paving in eight streets.—A contract has been awarded to the Southwestern Alcatraz Asphalt & Construction Co. for paving six squares with asphalt.

NEWPORT, KY.—Bids are asked until June 10 for paving Sixth st. with brick from York St. to Monmouth St. W. L. Glazier, Cy. Engr.

ASHLAND, O.—E. B. Westover, Cy. Clk., informs us that petitions for paving two streets with either brick or asphalt have been presented. F. L. Niederheiser, Cy. Engr.

ATHENS, O.—Bids are asked until June 16 for grading, excavating, graveling, etc., four sections of road. W. F. Scott, County Audr.

CALEDONIA, O.—The county commissioners have been petitioned to construct a stone road. Wm. Hart, G. C. Rinker and George Henry, County Comrs., Marion, may be addressed.

CINCINNATI, O.—Bids are asked until June 2 for paving Elmore St. with brick for 238 ft. A. P. Butterfield, Cy. Clk.—Bids are asked until June 25 for improving the Geist Road. Eugene L. Lewis, County Audr.

CLEVELAND, O.—The question of building a plank road on Woodland Ave., for a distance of five miles, at $2,500 a mile, is being considered by the county commissioners.

ORRVILLE, O.—Plans have been prepared by J. H. Holl, Engr., Canton, for laying brick pavement in Market St. Bids will soon be asked for the purchase of bonds.

GREENVILLE, O.—J. C. Weaver informs us that the city is testing two squares of broken stone paving. John Beers, Cy. Engr.

LIMA, O.—Bids are asked until June 23 for grading, draining and paving in Wayne St. C. E. Lynch, Cy. Clk.

TOLEDO, O.—Bids are asked until June 27 for asphalt or brick paving in Oak St. and Madison St. L. P. Harris, Cy. Clk.

WARREN, O.—Bids are asked until June 28 for about 12,000 sq. yds. of brick paving on North Park Ave. and High St. E. P. Dickey, Cy. Engr.

INDIANAPOLIS, IND.—Bids are asked by the Commissioners of Sullivan county, until June 28, for constructing four miles of free gravel roads, estimated to cost $8,8[illegible]. Audr., J. R. Riggs.

SOUTH BEND, IND.—Bids are asked until June 27 for constructing cement sidewalks, grading, etc., in Dubail Ave., from Michigan St. to Fellows St. L. A. Hull, Cy. Clk.

GRAND RAPIDS, MICH.—Bids are asked until June 6 for the purchase of $200,000 of street improvement bonds. Frank D. Warren, Cy. Clk.

OWOSSO, MICH.—Bids are asked until June 16 for constructing 18,800 sq. yds. of brick or asphalt pavement and 6,000 lin. ft. of curb, storm sewers, etc., as advertised in Engineering News. Riggs & Sherman, Engrs., 613 The Naseby, Toledo, O.

KEWANEE, ILL.—John C. Quade, Cy. Engr., writes us that a contract will be let about the first of July for 20,000 sq. yds. of brick pavement on concrete foundation; estimated cost, $39,000; also that a contract will soon be let for constructing sidewalks.

DE KALB, ILL.—Bids are asked until June 21 for 7,500 sq. yds. of brick paving and 4,000 ft. of curbing as described in our advertising columns. Engr., L. B. Merriam; Clk., E. A. Porter.

PANA, ILL.—We are informed that the question of constructing 11,000 sq. yds. of brick paving, at an estimated cost of $16,000, is being considered. Mayor Warren Penwell, Chn.; John Uhe and R. H. Kennedy, Bd. Local Improvements.

MINNEAPOLIS, MINN.—Resolutions have been passed to pave portions of four streets with asphalt and four alleys with granite. S. B. Loye, Pres. Council; Robert Pratt, Mayor.

ST. PAUL, MINN.—Bids are asked until June 6 for grading a road through Keller Marsh. D. M. Sullivan, County Audr.

BURLINGTON, IA.—Bids are asked until June 6 for paving a part of alley No. 4 with brick. Emmet Steer, Cy. Engr.

IOWA CITY, IA.—Bids are asked until June 6 for furnishing about 5,025 lin. ft. of curb, 3,500 cu. yds. of grading and 11,020 sq. yds. of brick paving. W. J. Bowen, Cy. Clk.; Arthur J. Cox, Cy. Engr.

SIOUX CITY, IA.—The street committee has recommended that portions of a number of streets and alleys be paved with brick. A resolution will come before the council June 14.

CARROLLTON, MO.—Wm. G. Busby, Mayor, writes us that the city is preparing to spend about $10,000 on brick paving. Contracts have not been let.

INDEPENDENCE, KAN.—Jno. M. Walker, Cy. Engr., writes us that six blocks of brick paving will be constructed.

INDEPENDENCE, MO.—H. H. Pendleton, Cy. Engr., informs us that the council has passed a resolution to pave the square with asphalt, an area of 7,500 sq. yds. The contract will be let about July 1.

WHARTON, TEX.—Bids are asked until June 13 for grading a road from Wharton to Half Moon Lake. J. G. Barbee, County Judge.

HOUSTON, TEX.—W. A. Polk, County Surv., has completed plans for the Harrisburg shell road and is now surveying for three other roads for which contracts will soon be let.

DENVER, COLO.—Bids are asked by the board of public works until June 4 for furnishing the material and repairing certain streets for this year. S. N. Wood, Pres. Bd. Pub. Wks.

LOS ANGELES, CAL.—A contract has been awarded to C. Stansbury, at $33,677, for grading, graveling and curbing Main St. for a distance of two miles.

TORONTO, ONT.—Chas. H. Rust, Cy. Engr., has recommended the purchase of 10,000 Massillon blocks and 15,000 Canadian brick, according to reports.

MANUFACTURING PLANTS.

HOULTON, ME.—The lumber mills of F. W. Titcomb were damaged by fire, May 27, causing a loss of about $75,000; no insurance.

HOLLISTON, MASS.—The harness factory of Hughs & Co. was destroyed by fire, May 27, causing a loss of about $35,000; partially insured.

STAMFORD, CONN.—The plant of the F. R. Gillespie Co., grinders of minerals, and located at Waterford, in this city, was damaged by fire, May 29, causing a loss of about $125,000. Mgr., Wm. W. Gillespie.

BROOKLYN, N. Y.—It is reported that the Market Refrigerating Co., Wallabout Dock and G St., will erect a new brick, iron and terra cotta cold storage building in this city, to cost $75,000. Mgr., W. J. Seaton; Arch., W. B. Tubby, 81 Fulton St., New York.

NEWARK, N. J.—A fire in this city, May 25, destroyed the 4-story leather factory of F. A. Schaeffer on Bergen St., causing a reported loss of $50,000.

PERTH AMBOY, N. J.—It is reported that Lewison Bros., copper smelters, have just bought 75 acres of land from the J. R. Watson Estate, near this town, and that they will establish here a copper refinery. The company at present has a refinery at Centre Falls, near Providence, R. I.

ENSLEY, ALA.—Press reports state that negotiations have been concluded for the building of a million dollar steel plant at Ensley City, six miles from Birmingham. Nat Baxter, Pres. Tennessee Coal, Iron & R. R. Co., is said to be interested. It is said that work will begin within 90 days, and that the plant will be the largest steel mill south of Pittsburg.

CLEVELAND, TENN.—W. S. Milne, manufacturer of chairs, Cleveland, writes us that he desires to purchase new pumps, steam pipes, shafting and pulleys and a 200-incandescent electric light plant for his new building. Boilers have already been purchased.

STOUGHTON, WIS.—The Stoughton Wagon Co.'s plant was burned, May 25, causing a reported loss of $50,000; fully insured.

BEATRICE, NEB.—We are informed that the Dempster Mill Mfg. Co., of Beatrice, manufacturers of windmills, wheat drills, etc., expects to erect several 2 and 3-story brick buildings, with wood and steel construction work, elevators, etc., and to have a total frontage of 1,000 ft., with a depth of 50 ft. A steam heating plant will be installed, also two 60-HP. engines and other machinery. Bids were asked for the buildings until May 25, but it is not expected to award the contract until June 15. Estimated cost, $69,000. Arch., George O. Berlinghof, of Beatrice.

SIOUX CITY, IA.—The Wilhelm Greisser Engineering Co., 909 Schiller Bldg., Chicago, Ill., informs us that it is now receiving bids on the equipment for the new brewing plant which it is to build in this city for the Sioux City Brewing Co., at an estimated cost of $250,000 for the buildings and $100,000 for the equipment. There will be installed several Corliss engines, tubular boilers, an electric light plant capable of supplying 150 lights, and several machinery freight elevators and conveyors.

GAS PLANTS.

CANASTOTA, N. Y.—This place has appropriated $3,000 for the sinking of a gas well.

PATCHOGUE (L. I.), N. Y.—Reports state that the Cranford Water Co., Brooklyn, John J. Bartlett, Representative, Greenport, has purchased land from the Patchogue Electric Light Co. for the erection of a gas plant.

RUTHERFORD, N. J.—A proposition has been presented to the council by the Passaic Lighting Co. to construct gas mains in East Rutherford, according to reports.

SOUTH ORANGE, N. J.—A contract has been awarded to the Newark Gas Co. by the village trustees for supplying gas for one year.

EAST LIVERPOOL, O.—The Alum Cliff Gas Co. is contracting for the laying of a pipe line to connect with the Bridgewater mains; estimated cost, $15,000.

CHICAGO, ILL.—It is reported that the Universal Gas Co. will construct a 5,000,000-cu. ft. gas holder.

NEW COMPANIES.—Electric Gas Regulator Co., San Francisco, Cal.; $30,000; C. T. Ryland, W. E. H. Williams, A. P. Sellor, S. C. Denson, W. C. Mahoney.

Suffolk Gas & Electric Light Co., Islip (L. I.), N. Y.; $200,000; to operate in Islip and Babylon; Charles F. Street, Hunter Wykes, William B. Hord, New York.

Clifton Electrolytic Gas Co., Clifton, N. J.; $10,000, with $1,000 paid in; Jean P. Genthen, Theodore N. Price, George Eckhart.

Alum Cliff Gas Co., East Liverpool, O.; J. R. Warner, Pres.; S. J. Cripps, Vice-Pres.; C. C. Ferguson, Secy.; John Mountford, Treas.; S. J. Crawford, J. S. Wilson, Will Reed, W. A. Hill, Dr. J. W. Gardner, T. F. Manley, S. F. Williams.

Los Angeles Gas Co., Los Angeles, Cal.; $1,000,000; W. J. Fay, A. C. Bilicke, T. S. C. Lowe, Thad. Lowe, E. W. Pratt.

Creed Oil Co., Wheeling, W. Va.; $200,000, with $100,000 paid in; to operate for oil and gas; O. D. Bleakley, Franklin, Pa.; H. S. Grayson, Pittsburg, Pa.; A. J. Mercer, Marietta, O.; J. W. Lee, M. C. Rodgers, Pittsburg, Pa.

Lone Star Petroleum Oil Co., Corsicana, Tex.; $20,000; J. J. Culberson, J. W. Broad, S. J. Hammen, Paris; R. K. Erwin, J. H. Miller, Osce Goodwin, Waxahachie.

MISCELLANEOUS CONTRACTS.

TELEPHONE LINE.—Lynnville, Tenn.—The board of commissioners has granted a franchise to the American Telephone & Telegraph Co.

TELEPHONE FRANCHISE.—Jamestown, N. Dak.—The council has granted a franchise to the North Western Telephone Co., Minneapolis, Minn.

TELEPHONE LINE.—Chattanooga, Tenn.—It is stated that the council will grant a new telephone franchise to J. A. Helvin & Co. An entirely new system will be put in.

PARK WORK.—St. Joseph, Mo.—An artificial lake, flower conservatory, etc., will be constructed this summer for the improvement of Krug Park. Superintendent Rue may be addressed.

TELEPHONE WORK.—Massillon, O.—The Central Union Bell Telephone Co., V. D. Green, Asst. Supt.; H. Krum, Ch. Engr., will make a number of improvements to its system in this place.

DREDGING.—Providence, R. I.—Bids are asked until June 2 for dredging in the Providence River and harbor. Joseph D. Grinnell, Chn.; D. F. Hayden, Clk. Harbor Com.; J. H. Shedd, Cy. Engr.

TOW BOATS.—St. Louis, Mo.—Bids are asked until June 24 for furnishing the services of five tow boats for dredging operations. Capt. H. E. Waterman, U. S. Engr., Mississippi River Comn., 2732 Pine St.

MORTAR CARRIAGES.—Washington, D. C.—Bids are asked by the war department until June 8 for furnishing about 95 spring return carriages for 12-in. mortars. Brig.-Gen. D. W. Flagler, Ch. of Ordnance.

DREDGING.—Southampton, N. Y.—Bids are asked until June 8 for dredging the canal between Shinnecock and Great South Bay, as stated in our advertising columns. Geo. W. Aldridge, Supt. Pub. Wks., Albany.

TELEPHONE LINE.—Camden, O.—The College Corner & Camden Telephone Co. has been incorporated to construct a line between Camden and College Corner, a distance of about 15 miles, according to reports.

BREAKWATER AND PIERS.—Goderich, Ont.—Reports state that new bids will be asked by the provincial government for constructing a breakwater and repairing the piers, to cost about $75,000, according to reports.

TELEPHONE SYSTEM.—Mankato, Minn.—An ordinance is being considered by the council authorizing the granting of a franchise to Lorin Craig, Pres. of the Mankato Citizens' Telephone Co., to operate a telephone system.

PAVING.—Hartford, Conn.—We are informed that the following bids were received May 25 for granite block paving, as advertised in Engineering News; Geo. Nevers, Clk. Bd. St. Comrs.:

Bidder.	Granite block, a sq. yd.	Asphalt, a sq. yd.
John Hanna's Sons, New Britain	$3.76	.....
Fred. T. Ley & Co., Springfield, Mass.	3.80	.....
Hartford (Conn.) Paving & Const'n Co.	3.09	$2.75
Booth Bros. & Hurricane Isle G. Co.	3.07	2.75
E. R. Patteson, Hartford, Conn.	3.72	...
Jas. Grant & Co., New York	3.54	...
August Flege, Waterbury, Conn.	3.65	...
Connecticut Concrete Co., New Haven	3.51	2.65
Chas. W. Blakeslee & Son, New Haven	3.21	2.70
	3.11	...

SIDEWALKS.—Vailsburg, N. J.—William Billington, Clk., informs us that the following bids were received May 18 for constructing artificial stone sidewalks, as advertised in Engineering News, and the contract awarded Wm. H. Turrell:

Bidder.	Sidewalks, 4 x av., a sq. ft.	Excav., a cu. yd.
Chas. L. Pitts, 17 Division St., New York	$0.15⅝	$0.35
Wilson-Baillie Mfg. Co., 9th St., Brooklyn	.17½	.35
John Kenny, Jr., 120 Broadway, N. Y.	.12½	.12
Frank Batsch, Newark, N. J.	.18	.35
W. H. Turrell, 22 Clinton St., Newark, N. J.	.14¼	.20

BRIDGE SUPERSTRUCTURE.—Chicago, Ill.—The following bids were received May 18 by the board of trustees of the Sanitary District for erecting a superstructure for the Kedzie Ave. bridge over the Main Channel on Section N, as advertised in Engineering News; the King Bridge Co. also bid $28.00 for oak under the extra lumber head; Jas. Reddick, Clk.:

Bids Received at Chicago, Ill., May 18, for Erecting a Superstructure for the Kedzie Ave. Bridge.

Bidder.	Superstructure, lump sum.	Extras, price in cts., a lb.—Med. or soft st'l.	Steel cast'gs.	Iron cast'gs.	Phosphr. bronze.	Extra lumber, a 1,000 ft. B.M.
King Bridge Co., Cleveland, O.	$21,315	2.9	4.7	2.9	21	$23.00
Carnegie Steel Co., Pittsburg, Pa.	22,087	2.75	6.0	4.5	20	31.00
Pittsburg Bridge Co., Pittsburg, Pa.	22,100	2.85	5.15	4.15	25	29.00
C. L. Strobel, Chicago, Ill.	22,200	3.5	6.3	2.8	33	28.00
Wisconsin Bridge Co., Milwaukee, Wis.	22,880	3.25	5.0	3.0	30	25.00
Toledo Bridge Co., Toledo, O.	24,360	2.75	4.5	3.0	25	30.00
Edge Moor Bridge Works, Wilmington, Del.	26,900	3.0	6.0	4.0	25	30.00

TELEPHONE CONDUITS.—Seattle, Wash.—The Sunset Telephone & Telegraph Co. proposes to construct a system of conduits in the four principal streets of the city and will erect a new office building on 3d Ave.; these improvements will cost about $80,000.

EMBANKMENT AND ROCK EXCAVATION.—Lemont, Ill.—Bids are asked until July 20 for constructing a railway embankment and removing rock from the main channel, as stated in our advertising columns. James Reddick, Clk. Bd. Trustees Sanitary Dist., Chicago.

LEVEE WORK.—New Orleans, La.—Bids are asked until June 16 for constructing about 1,366,500 cu. yds. of earthwork at the Fourth Mississippi Levee District, and not June 9, as stated last week. Capt. Geo. McC. Derby, U. S. Engr., 3232 Prytania St., New Orleans.

TELEPHONE SYSTEM.—Fort Collins, Colo.—The Colorado Telephone Co. is making arrangements to construct a line 23 miles long from this place to Livermore. The pole line will cost about $1,200. J. H. Swan, Livermore, is interested; Edward Burgess, Denver, may be addressed.

CONTRACT PRICES.

BRIDGE SUBSTRUCTURE.—Chicago, Ill.—The drainage board received the following bids May 18 for supplying and erecting the substructure for the A., T. & S. Fe Ry. Co.'s bridge across the main channel on Section 8, as advertised in Engineering News:

Bidder.	Rock excavation, 433 cu. yds.	Portland cement concrete, 372 cu. yds.	Masonry, 416 cu. yds.	Total.
McArthur Bros, Co.*	$0.50	$5.50	$12.00	$7,255
Sackley & Co., Chicago	1.00	4.43	15.15	8,383
A. T. Young & Co., Chicago	1.20	5.00	14.95	8,599
Sackley & Peterson, Chicago	1.00	4.43	16.15	8,799
Ft. Madison & Appanoose Stn Co.	1.00	5.00	16.00	8,949
Griffiths & McDermott, Chicago	1.45	6.95	14.49	9,241

*And Winston & Co., Chicago.

BRIDGE SUPERSTRUCTURE.—Chicago, Ill.—The drainage trustees received the following bids May 18 for supplying and erecting the superstructure for the A., T. & S. Fe Ry. Co.'s bridge, across the main channel, as advertised in Engineering News:

Bids Received at Chicago, Ill., May 18, for Superstructure of the A., T. & S. Fe Ry. Co.'s Bridge.

Bidder.	Superstructure, lump sum.	Extras, a lb.—Medium or soft steel, cts.	Steel castings, cts.	Iron castings, cts.	Phosphr. bronze, cts.	Counter weight castings, cts.
Carnegie Steel Co., Ltd., Pittsburg, Pa.	$76,185	2.55	6.0	4.5	20	1.5
C. L. Strobel, Chicago, Ill.	81,350	3.5	6.3	2.8	33	1.2
Detroit Bridge & Iron Works, Detroit, Mich.	81,387	3.05	5.5	3.9	30	1.5
King Bridge Co., Cleveland, O.	83,577	2.9	4.7	2.9	21	1.3
American Bridge Works, Chicago, Ill.	88,200	3.0	4.5	2.0	25	1.25
Chicago Bridge & Iron Works, Chicago, Ill.	89,500	3.15	6.35	2.25	15	1.55
Edge Moor Bridge Works, Wilmington, Del.	91,800	3.0	6.0	4.0	25	1.0

REPAIRING MATERIALS.—Baltimore, Md.—The following bids were received May 12, for furnishing materials for general purposes, repairing, etc., as may be required during the year; all bidders of Baltimore: Sand—R. C. Mitchell & Sons, 56⅞ cts. a cu. yd.; Gibson & Shipley, 85 cts.; M. F. Leonard, 70 cts.; F. G. Duhurst, 60 cts.; D. A. Leonard, 71 cts.; Geo. W. Howser, 55 cts.; Lumber (Georgia pine)—W. D. Gill & Son, $18.95 a 1,000 ft.; (North Caroline lumber) $10.50, awarded contract. The following bids were also received for furnishing gutterstones, etc.:

Bidder.	Cobble-stone, perches.	Curbstones—4½-in., lin. ft.	Curbstones—5-in., lin. ft.	Gutter-stones, lin. ft.	Flag-stones, sq. ft.
Schwind Quarry Co.	$1.71	$0.50	$0.60	$0.26	$0.28
D. A. Leonard	1.72	...	...	.28	...
I. H. Peddicord	1.72	.48	.58	.25	.28
J. H. Atkinson	1.80	.50	.60	.245	.26
Jno. T. Curley & Co.	1.75	.45	.55	.24	.30
H. T. Campbell	1.65	...	...	...	...
Albert Weber	...	.54	.67	...	...
J. Merrick Horn	...	.65	.65	.30	.30

ASPHALT PAVING.—Camden, N. J.—We are informed that the following bids were received May 23 for asphalt paving, as advertised in Engineering News; the Alcatraz Co. bid on one street, with long haul, $1.445, with balance as given below; Ward & Co. one street, no cobbles to crush, $1.69; Pennsylvania Co., one street, no cobbles to crush, $1.60; the bids include removing present paving, excavating; crushing pavement; 6-in. natural concrete foundation; 1-in. binder asphalt, 2-in. top asphalt with 10-year guarantee; the streets are nearly all paved with cobbles or inferior blocks which are to be crushed for concrete; contract will probably be awarded June 2; Cy. Engr., L. E. Farnham:

Items.	Aaron Ward & Co., Camden, N. J.	Pruin-Bambrick Co., 220 Broadway, N. Y.	Vulcanite Pav'g Co., 1710 Market St., Philadelphia.	Pennsylvania Asp. Co., 513 Fidelity Bldg., Philadelphia	Alcatraz Paving Co., 1424 Witherspoon Bldg., Philadelphia
Sheet asphalt	$1.55	$1.80	$1.55	$1.59	$1.39
Granite blocks	1.81	2.50	1.80	2.00	1.90
Circular curb, 6-ft. radius	1.23	1.50	1.00	1.75	1.25
Protection curb	.41	.90	.50	.65	.37
24-in. granite crossing foot	.83	...	...	.75	.80
16-in. " " "	.24	...	...	.60	.25
4x20-in. granite curb	.30	.90	.40	.65	.30
4x12-in. bluestone gutter	.14	...	...	.40	.15
Repaving	.08	.35	.25	.25	.15
Restg curb & repr 2-ft. wlk	.08	.40	.15	.15	.10
Resetting gutters	.01	...	...	.10	.02
Concrete in place	2.30	...	...	4.00	4.50
Extra earth excavation	.25	...	...	.25	.30

*Representing Columbia Construction Co. of New York.

BRICK PAVING.—Fulton, N. Y.—We are informed that the following bids were received May 27, for 800 sq. yds. of brick paving, and 300 ft. of curbing; the award to be made June 3; O. C. Breed, Cy. Engr.:

	1.	2.	3.	4.	Total
T. H. Marvin, Fulton, N. Y.	$1.97	$0.64	$0.40	$18.00	$1,782
A. S. Webb, Syracuse, N. Y.	2.04	.50	.25	5.00	1,780
Edw. Quirk, Fulton, N. Y.	3.00	1.25	.80	25.00	2,801
J. Hendricks, Oswego, N. Y.	2.40	.80	.35	10.00	2,155

1. Is for 800 sq. yds. paving complete with concrete foundation; 2. 250 lin. ft. curb complete with foundation and drain; 3. 71 lin. ft. curb reset; 4. Crosswalk reset.

SEWER MATERIALS.—Baltimore, Md.—The following bids were received May 11 for furnishing materials for a sewer in Brice Alley; L. F. Lewis, Cy. Comr.: Stone for haunching, 4,100 cu. yds.—Albert Weber, $1.69 a cu. yd. (accepted); J. H. Atkinson, $2.00; D. A. Leonard, $2.19; John T. Curley & Co., $2.25; Schwind Quarry Co., $2.50; I. H. Peddicord, $2.30. Brick (hand made), 195,000—Jas. R. Busey & Son, $6.45 a 1,000 (accepted); Smith & Schwartz Brick Co., $6.75; Pitcher & Creager Brick Co., $6.50; Druid Brick Co., $8.48. Brick (machine-made) 455,000—Busey & Son, $5.95 a 1,000 (accepted); Pitcher & Creager, $6.00; Druid Brick Co., $7.48. Vitrified brick, 81,000—Montello Brick & Clay Co., Reading Pa., $17.50 a 1,000; Isaac S. Filbert, $17.48 (accepted); B. Wallis & Co., $18.00. Sand 2,000 cu. yds.—Wallis & Co., $1.00 a cu. yd.; F. G. Duhurst, 64 cts. (accepted); Wm. F. Leonard, 70 cts.; Gibson & Shipley, 85 cts.; Michael McGovern, 64 cts. Cement, 4,500 bbls., Natural, Cumberland and Potomac—National Building Supply Co., $1.18½ a bbl.; Cumberland hydraulic—Wallis & Co., $1.10; Hoffman cement—Wallis & Co., $1.15; Union cement—Geo. M. Hay, $1.04; Domestic Portland cement, 300 bbls., Atlas—National Building Supply Co.,

$2.26; W. Wirt Clarke & Sons, $2.35; Scepter cement—National Building Supply Co., $2.20; Giant cement—G. M. Hay, $2.28; Faltec cement—Maryland Cement Co., $2.05, and $1.46 for Patapsco; Foreign Portland cement, Porta—National Building Supply Co., $2.40 and $2.35 for Kaiser; Hemmoor cement—Clarke & Sons, $2.60.

GIRDER BRIDGE, ETC.—Syracuse, N. Y.—We are informed that the following bids were received May 23 for constructing a steel girder bridge over Onondaga Creek at West Water St.; contract awarded Kenny & Kenny; R. R. Stuart, Cy. Engr.:

Bids Received at Syracuse, N. Y., May 23, for Steel Girder Bridge.

Bidder.	Steel girder bridge.	Asphalt sheet pavement, 270 sq. yds.	Vit. brick pavement, 500 sq. yds.	Stone sidewalk, 60 sq. ft.	Stone sidewalk relaid, 200 sq. ft.	Curbing, 130 lin. ft.	Railing, 21 lin. ft.	Yellow pine lumber, 1,000 ft.	Total.
Kenny & Kenny, New York, N. Y.	$3,550.00	$1.90	$1.55	$0.50	$0.08	$0.60	$0.60	$25.00	$4 999
Stone & Thurston, New York, N. Y.	4,760.00	2.40	1.80	.10	.02	.60	1.00	29.00	6,446
Hilton Bridge Co., Albany, N. Y.	3,875.00	2.15	2.10	.30	.10	.65	1.00	40.00	5,689
Groton Bridge & Mfg. Co., Groton, N. Y.	3,575.00	2.10	2.20	.31	.20	.82	1.00	38.00	5,466
Raphael X. Basford, Canton, O.	3,800.00	2.25	1.95	.20	.10	.75	1.00	35.00	5,568
Owego Bridge Co., Owego, N. Y.	3,456.00	2.05	2.05	.25	.15	.70	1.00	25.00	5,217
Chas. F. Taylor & Co., Syracuse, N. Y.	3,932.50	2.10	2.25	.30	.15	.80	1.00	40.00	5,838
Berlin Iron Bridge Co., East Berlin, Conn.	3,492.00	2.25	2.10	.30	.15	.75	1.00	40.00	5,355
The Youngstown Bridge Co., Youngstown, O.	3,483.00	2.10	2.12	.25	.20	.75	1.00	30.00	5,314
Pittsburg Bridge Co., Pittsburg, Pa.	4,216.00	2.35	1.65	.20	.06	.65	.75	30.00	5,830

STEEL FORGINGS.—Washington, D. C.—It is stated that the Bethlehem Iron Co. and the Midvale Steel Co. submitted the only bids for furnishing two sets of steel forgings for 8-in. guns, each bidding 23 cts. a lb. The Bethlehem company promised to furnish the forgings in from 40 to 65 days, and the Midvale company in from 50 to 70 days.

BRICK PAVING.—Meridian, Miss.—It is reported that C. H. Budd, of St. Louis, Mo., has been awarded the contract for 10,000 sq. yds. of brick paving, at $1.80 a sq. yd.

WATER DEPARTMENT SUPPLIES.—Harrisburg, Pa.—It is stated that the following contracts were let last week for annual supply of water-works materials: Water Pipe—M. J. Drummond & Co., New York, at from $15.90 to $16.65 a ton; Valves—Rensselaer Mfg. Co., Troy, N. Y., from $7.20 to $440; Fire Hydrants—Eddy Valve Co., Waterford, N. Y., at $25.50 a hydrant; Ferrules—H. Mueller Mfg. Co., Decatur, Ill., $6.98 to $16.28; Iron and Brass Castings—W. O. Hickok Mfg. Co., Harrisburg, 1½ cts. a lb.

STONE ABUTMENTS.—Syracuse, N. Y.—R. R. Stuart, Cy. Engr., informs us that the following bids were received May 23 for constructing two stone abutments at Onondaga Creek and West Water St.; the bid of John Crabtree was accepted; all are local bidders except Stone & Thurston, of New York:

Bids Received at Syracuse, N. Y., May 23, for Constructing Two Stone Abutments.

Quantities.		Chas. T. Hookway.	Henry Ryan.	Stone & Thurston.	A. Van Wagnen & Co.	Martin & Sullivan.	Chas. F. Taylor & Co.	Edwd. S. Candee.	John Crabtree.
Removing old bridge		$100.00	$25.00	$50.00	$50.00	$100.00	$68.00	$50.00	$15.00
Bailing and draining		500.00	550.00	300.00	300.00	800.00	498.00	450.00	300.00
Earth excavation	1,700 cu. yds.	.40	.30	.33	.30	.35	.47	.30	.35
Excavating old masonry	325 " "	.50	1.00	.50	.50	.60	.65	1.00	.50
Embankment	900 " "	.30	.20	.50	.20	.10	.33	.25	.20
Bridge seats and coping	18 " "	25.00	8.75	14.00	10.00	16.00	16.00	18.00	10.00
Masonry:									
Abutmts & wing walls	460 " "	6.00	5.00	6.20	6.75	7.00	6.50	6.75	5.25
Concrete	70 " "	4.00	3.75	4.50	4.00	5.00	4.10	4.50	3.75
Loose stone	22 " "	1.50	3.00	1.00	.50	1.00	1.00	1.00	3.00
Hemlock timber	10 M. ft.	20.00	15.00	6.00	15.00	15.00	17.00	16.00	15.00
Wrought iron	50 lbs.	.05	.25	.05	.06	.05	.10	.06	.05
Spikes and nails	200 "	.03	.02	.05	.05	.03	.05	.05	.03
Taking up old sidewlks.	260 sq. ft.	.03	.04	.05	.10	.05	.09	.05	.04
24-in. pipe sewer	14 lin. ft.	1.00	1.00	1.00	.80	.75	1.30	.40	.95
10-in. pipe sewer	64 " "	.30	.50	.60	.40	.20	.40.	.40	.35
C.-i. recvrs and hoppers	2 each	10.00	8.00	15.00	6.00	4.00	10.00	10.00	12.00
Total		$5,505	$4,604	$5,432	$5,016	$5,863	$5,732	$5,563	$4,395

SEWERS.—Scranton, Pa.—The following bids were received May 26 for constructing sewers in Section B, fifth sewer district: Approximate estimate, $24,863; length, 10,880 lin. ft. of 8, 10, 12, 15, 18, 20, 24 and 27-in. pipe; average depth, 10.5 ft. The price a lin. ft. includes the construction of 53 manholes, 20 basins, and 304 house connections (about 5,100 ft.); Flanagan & O'Hora, Scranton, $1.78 a ft. complete; extra side basins, $80; extra corner basins, $90; extra manholes, $40. V. H. O'Hara, Scranton, $1.69 a ft. complete; extra basins, $80; extra manholes, $30. Donohoe & O'Boyle, Scranton, $1.93 a ft. complete. Jos. P. Phillips, Cy. Engr.

ENGINEERING MATERIAL PRICES.

TRACK MATERIALS—
New York—Angle bars, 1.05 cts. to 1.10 cts.; spikes, 1.40 cts. to 1.50 cts.; track bolts, hexagonal, 1.80 cts. to 1.85 cts.; square, 1.60 cts. to 1.75 cts.
Chicago—Angle bars, 1.15 cts. to 1.25 cts.; spikes, 1.50 cts. to 1.60 cts.; track bolts, hexagonal, 1.90 cts. to 2.00 cts.; square, 1.80 to 1.90 cts.

RAILS, STEEL—
New York, new, $18.00 to $19.00; old iron, $11.00 to $11.50; old steel $9.00.
Chicago, new, $20.00 to $22.50; old iron, $12.00 to $12.25; steel, $10.50 to $11.00.
Pittsburg, new, $18.00 to $19.00; old iron, $12.50; steel, $10.50.

STRUCTURAL STEEL—
New York—Beams, 1.30 cts. to 1.35 cts.; channels, 1.30 cts. to 1.35 cts.; tees, 1.35 cts. to 1.40 cts.; angles, 1.15 cts. to 1.20 cts.; plates, 1.20 cts. to 1.30 cts.; rivets, iron, 2.25 cts. to 2.50 cts.; steel, 1.75 cts. to 1.85 cts.; universal mill plates, 1.15 cts. to 1.20 cts.; tank, 1.25 cts. to 1.30 cts.; shell, 1.25 cts. to 1.30 cts.; flange, 1.60 cts. to 1.75 cts.; firebox, 2.25 cts. to 2.50 cts.
Chicago—Beams, 1.30 cts. to 1.45 cts.; channels, 1.30 cts. to 1.45 cts.; tees, 1.35 cts. to 1.40 cts.; angles, 1.20 cts. to 1.25 cts.; universal mill plates, 1.25 cts. to 1.30 cts.; tank, 1.15 cts. to 1.20 cts.; shell, 1.45 cts. to 1.55 cts.; flange, 1.20 cts. to 1.40 cts.; firebox, 1.85 cts. to 5.00 cts.
Pittsburg—Beams, 1.15 cts. to 1.25 cts.; channels, 1.15 cts. to 1.25 cts.; tees, 1.15 cts. to 1.20 cts.; angles, 1.00 ct. to 1.15 cts.; universal mill plates, 1.05 cts. to 1.15 cts.; tank, 1.05 to 1.10 cts.; shell, 1.15 cts. flange, 1.10 cts. to 1.20 cts.; firebox, 1.50 cts. to 2.75 cts.

MERCHANT STEEL—
Machinery, per lb., 1.60 cts. to 1.65 cts.
Cast, best in small lots, per lb., 5.50 cts. to 7 cts.
Sheet, per lb., 8.5 cts.

IRON—
Pig Iron:
New York, No. 1, $11.00 to $11.50; No. 2, $10.75 to $11.00.
Chicago, No. 1, $11.50 to $12.00; No. 2, $11.00 to $11.50.
Pittsburg, No. 1, $10.40 to $10.50; No. 2, $9.90 to $10.00.
Bar Iron:
New York, common, 1.08 cts. to 1.15 cts.; refined, 1.15 cts. to 1.20 cts.
Chicago, common, 1.05 cts. to 1.15 cts.; refined, 1.10 cts. to 1.20 cts.
Sheets:
American, per lb., 4 cts. to 4½ cts.
Russia, per lb., 10½ cts. to 11½ cts.

LUMBER—
New York:
Hemlock timber, 20 ft. and under, per M, $12.00 to $12.50.
Piling, Eastern spruce, 35 to 40 ft., 30 to 40% 12-in. butts, 4¼ cts. to 4½ cts.
Spruce, special cargoes, per M, $15.00 to $17.50.
Yellow pine, random cargoes, $14.50 to $17.00.
North Carolina pine, $2.25 to $2.40 advance over Norfolk rates.
San Francisco:
Oregon pine, per M, $15.50 to $17.50.
Redwood, per M, $17.00 to $19.00.
Redwood tank stock, up to 10 ft., $21.00 to $24.00.

GENERAL MATERIALS—
Lead, New York, 3.75 cts. to 3.80 cts.
Nails, Pittsburg, 1.40 cts.
Solder, per lb., 9 cts. to 11½ cts.
Spelter, per lb., 4.00 cts. to 4.30 cts.
Copper, ingots, 11.50 cts. to 12.00 cts.
Granite, rough, New York, cu. ft., 40 cts. to 50 cts.
Limestone, New York, cu. ft., 70 cts. to 80 cts.
Ohio freestone, New York, cu. ft., 85 cts. to 90 cts.
Slate, Penn. block, per square, $4.00 to $5.00.
White lead, American, per lb., 5½ cts. to 6 cts.
Lime, common state, per bbl., 70 cts.

INDUSTRIAL NOTES.

THE O. H. JEWELL FILTER CO. has removed its offices from 73 and 75 Jackson St. to 40 and 42 West Quincy St., Chicago.

THE WILLIAM CRAMP & SONS SHIP & ENGINE BUILDING WORKS, Philadelphia, is reported to have contracts amounting to $15,000,000 from the Russian government for the construction of 12 warships. This is said to be the largest foreign contract for war purposes ever secured by an American firm. The contract calls for one first-class battleship, one first-class criuser, and 10 torpedo-boat destroyers.

THE BALDWIN LOCOMOTIVE WORKS, Philadelphia, is reported to have received orders for 77 locomotives for the Trans-Siberian & Chinese Eastern R. R., through the Russo-Chinese Bank, as agents for the Russian Government. Of this order 50 will be 70-ton consolidation freight locomotives with tenders and the remainder will be six-coupled tank locomotives, weighing 86,000 lbs. each, all of the Vauclain compound type.

THE BERLIN IRON BRIDGE CO., East Berlin, Conn., is erecting the steel work of a two-story power house, 50 ft. square, for the Bryant Electric Co., Bridgeport, Conn. The building is of brick and a steel framework, skeleton type. The floor is supported on heavy girders and columns, which carry steel joists supporting corrugated iron arches and a concrete floor. The roof has clear span trusses and corrugated iron covering, lined with patent anti-condensation roof lining.

THE Q. & C. CO., Chicago, reports a large order for McKee brake-slack adjusters from New York, for shipment to a railway in Peru. These goods are much used abroad as well as in the United States, where they are now in use on 32 different roads. The company has also made shipment of one of its largest power sawing machines, No. XXXXX., to Sheffield, England. The machine carries a 36-in. blade and is used for cutting risers and gates off steel castings.——In order to meet the large demands made by increasing trade, the company is preparing to add additional facilities to its works at Chicago Heights, enlarging its plant with the addition of a wing.

THE KOKEN IRON WORKS, St. Louis, Mo., has added a building 100 x 150 ft. to its plant during the past year, and has equipped the same for making all classes of heavy railway and general bridge work. The machinery is operated by electricity, including a 10-ton electric traveling crane, which passes out of the building through doors and on trestles to the railway tracks, enabling the same crane to serve the shop and also to load the finished product and unload the raw material. The plant covers an area of six acres. The annual output is about 12,000 tons. The company has recently completed plans for a building at 715 Locust St., to be known as the Koken Bldg. It is a modern fireproof building of nine stories, 24 x 100 ft. The city office is located in this building, and the main office and works at Manchester and Chouteau Aves. Among large buildings erected by the firm are the Liggett & Myers tobacco factories and the Coliseum, St. Louis. Contracts for several bridges are on hand.

THE WESTINGHOUSE ELECTRIC & MFG. CO., Pittsburg, Pa., through its London representatives, has installed a 135-K-W. single-phase separately-excited alternator, belted to a Westinghouse engine, for the Malaga Electricity Co., Malaga, Spain.——The company recently supplied the Fries Mfg. Co., Salem, N. C., with six Type C induction motors, and a number of lightning arresters, high-tension transformers, etc., to be used for operating a rectifying machinery, and for driving a city pumping station, planing mill, machine shop, iron foundry, etc.——The plant of the Dennison Mfg. Co., South Framingham, Mass., is entirely run by electric apparatus of Westinghouse manufacture. A complete system of arc and incandescent lighting is also in operation. The generating plant, which consists of one 200-K-W. dynamo, running at 100 revolutions a minute; one 100-K-W. dynamo of the same speed, and one 300-K-W. dynamo running at 300 revolutions, are all of the 125-volt type. Also 17 slow-speed Westinghouse multipolar motors of from 5 to 50 HP. are used for driving the shop machinery.——The company is installing for the Berlin Mill Co., Berlin, N. H., two 100-K-W. 400-volt dynamos and an equipment of Type C induction motors, for driving planing and grist mills, machine shops and for lighting the plant. The extreme distance of any motor from the generator does not exceed 350 ft. Another electrically equipped lumber mill supplied by the company is that of the M. G. Shaw Lumber Co., Bath, Me.——The Atlas Tack Co., Taunton, Mass., has adopted electricity for shop power. A 150-K-W. 440-volt Westinghouse three-phase generator of 3,000 alternations, has been installed, with nine Type C motors, for the operation of three large tack mills, extending for a radius of 1,500 ft. about the power plant. The installation of this apparatus will enable the purchasers to shut down two steam plants, to cut out considerable shafting, and to increase the efficiency of the entire plant. Some 20 or 30 additional motors and a 1,000-light dynamo are to be installed in a short time.

ARTESIAN WELL.

NORWOOD, DELAWARE CO., PA.

Sealed proposals will be received by the Committee on Water Supply for the Borough of Norwood, Pa., up to 6 o'clock p. m., June 9th, 1898, for sinking an eight or ten-inch Artesian Well.

For further particulars, call upon or address Mr. J. S. McMurtrie, Chairman of Committee, between 10 a. m. and 12 noon, at No. 525 North Ninth St., Philadelphia, Pa., or after 1 p. m., at Norwood. The right is reserved to reject any or all bids.

CHAS. H. BOND,
Clerk of Committee.

May 31st, 1898. 22-1t

LAYING PAVING BRICK.

HOLYOKE, MASS.

Sealed proposals will be received by the undersigned until 7 o'clock p. m., Friday, June 10, 1898, for laying six thousand (6,000) square yards, more or less, of vitrified paving brick upon Appleton Street, Holyoke, Mass., according to specifications, which may be obtained at the office of the undersigned, Room No. 2, City Hall.

A certified check for two hundred ($200) dollars, drawn payable to the order of the City of Holyoke, Mass., must accompany all bids in compliance with Section 51 of "An Act to Revise the Charter of the City of Holyoke."

Bids to be marked "Proposals for Paving" and addressed to the Chairman of the Board of Public Works.

THE BOARD OF PUBLIC WORKS,
MICHAEL F. WALSH, Chairman.
OSCAR C. FERRY, Asst. Clerk.

Holyoke, Mass., May 27, 1898. 22-1t

SEWERS.

CITY ENGINEER'S OFFICE,
SPRINGFIELD, MASS., May 31, 1898.

Sealed proposals, endorsed "Proposal for Sewers," will be received at the above office until Tuesday, June 14th, 1898, 12 o'clock m., for the construction of brick sewers in Bancroft and Chestnut streets, and the extension of Douglas Street. Approximate quantities are as follows:

Bancroft and Chestnut Streets.

1,353 lineal feet of 3 ft. 4 ins. x 5-ft. brick sewer, egg-shaped.
406.5 lineal feet of 3 ft. 2 ins. x 4 ft. 9-in. brick sewer, egg-shaped.

Douglas Street Extension.

422 lineal feet of circular brick sewer, 4 ft. 6 ins. diameter.
440 lineal feet of circular brick sewer, 4 ft. diameter.

Plans may be seen, specifications, form of proposal and other information may be obtained at the City Engineer's office.

The right is reserved to reject any or all bids.

Per order of the Committee on Sewers and Drains.

DWIGHT O. GILMORE,
CHAS. E. BROWN,
HOMER D. PACKARD,
Committee on Sewers and Drains.
WM. L. DICKINSON,
CHAS. M. SLOCUM, Supt. of Streets.
City Engineer. 22-2t

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Vol. XXXIX., No. 22.

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"De Pontibus" from the Standpoint of the Consulting Engineer—A Simple Rule for Determining the Maximum Bending Moment from Concentrated Loads (illustrated).

THE MAXIM AERIAL TORPEDO is the invention of Mr. Hudson Maxim, brother of the gun inventor, Hiram Maxim. The Maxim Powder & Torpedo Co., of New York, successor to the Zalinski Dynamite Gun Co., is seeking to induce the government to adopt the aerial torpedo gun for coast defence, and also to spend $500,000 on a torpedo cruiser. The new appliance is not described, other than that cordite is to be used in expelling a torpedo, which will carry 1,000 lbs. of compressed gun cotton, or picric acid, to a distance of "nine miles." This half-ton torpedo would have a destructive effect over an area of more than 200 ft. square. It is also claimed that a one-ton shell can be thrown five miles.

WAR BALLOONS are to be used in the Cuban campaign, and three are ready for service and a fourth is being made. The war-balloon train will be under the command of Major Joseph E. Maxfield, of the Signal Corps at Tampa. The outfit will include apparatus for making gas and compressing air to 100 atmospheres, cables for anchorage, etc. It is suggested that by their use explosives may be dropped upon Cervera's ships in Santiago harbor; but observation will be their chief practical purpose.

THE HOLLAND SUBMARINE BOATBUILDER, Mr. J. J. Holland, seems to have faith in his craft sufficient to propose to the government to attempt the job of exploding the mines in the entrance to Santiago harbor, by firing submarine torpedoes from the "Holland," and then to proceed against the Spanish ships.

THE CHILIAN CRUISER "O'HIGGINS," which our government, and Spain as well, attempted to purchase, has had her trial trips. She was launched in 1897, and has the following dimensions: Length, 412 ft.; beam, 62 ft. 9 ins.; mean draft, 22 ft.; displacement on this draft, 8,500 tons; coal capacity, 700 tons; engines, 16,000-I. HP.; speed for 24 hours, over 19 knots. The mean of six runs, with full power, over the measured mile, with and against the tide, was 21.7 knots. Her armament includes three 8-in., ten 6-in. and two 4.7-in. guns, all protected by 6-in. and 5-in. armor, and the secondary battery contains ten 12-pdrs. and ten 6-pdrs., protected by shields. She has five torpedo tubes, two of them submerged. The "O'Higgins" has a 7 to 5-in. water line Harveyized steel armor belt 7 ft. deep, covering two-thirds of her length, and a complete protective deck from 1½ to 2 ins. thick.

THE U. S. PROTECTED CRUISER "COLUMBIA" collided with and sank the English tramp steamer "Foscolia," of 1,536 gross tonnage, on the evening of May 28, off New York harbor. The steamer was first seen, on port bow, not more than 150 yds. distant. The "Columbia" was forced ahead at full speed, but the bow of the "Foscolia" caught the forward sponson on the "Columbia's" quarter, and the stem of the English vessel was broken off and remained in the side of the American ship. On the "Columbia" a hole was made extending below the waterline and from 2 to 8 ft. wide, about 40 ft. from the stern. Collision quarters were sounded and the water-tight compartments were closed almost before the collision occurred. The 2½ to 4-in. steel protective deck doubtless saved the "Columbia" from serious injury; as it is, a part of the sponson was demolished, the gun in the sponson was injured in its mechanism and some frames and plates badly damaged. She came to the Brooklyn yard at once for repairs and is now in the dry-dock. The "Columbia" has a displacement of 7,375 tons, and from her speed of 22.8 knots she was especially useful at this time as a scout boat.

THE MOST SERIOUS RAILWAY ACCIDENT of the week occurred on the Alabama Great Southern R. R., at Graysville, Tenn., on May 27. A light northbound engine collided with a southbound passenger train. Four of the five men composing the crew of the northbound engine were instantly killed, the fifth receiving serious injuries. One of the engines blew up but no passengers were injured. The accident is said to have resulted from the light engine running without orders.

TWO MORE POWDER MILLS WERE BLOWN UP, one at Hammond, Ind., on May 21, resulting in the death of one person and the injury of two, the other at Hazardville, Conn., in which one man was killed. The former is attributed to Spanish spies.

THE STEAMSHIP "PRESQUE ISLE," launched by the Cleveland Shipbuilding Co., at Lorain, on May 25, has the following dimensions: Length over all, 426 ft.; keel length, 406 ft.; beam, 50 ft.; depth, 28 ft.; carrying capacity on 14-ft. draft, 6,000 tons; cost, $200,000. The boat has a steel tank top and a 5½-ft. water bottom, extending from collision bulkhead to engine room bulkhead and divided into three compartments. She will have quadruple expansion engines and two Babcock & Wilcox water tube boilers. The boat is built for the Presque Isle Transportation Co.

THE NEW GRAVING DOCK of the Clyde Navigation Trust, at Glasgow, has the following general dimensions, according to "The Engineer," of London:

Length of floor, inside of caisson to head of dock	880 ft.
Width at bottom	81 ft. 8 ins.
Width at top	115 ft.
Width of outer entrance, top and bottom	83 ft.
Width of inner entrance, top and bottom	83 ft.
Depth on sill, outer entrance	26 ft. 6 ins.
Depth on sill, inner entrance	27 ft.
Floor of dock below average high water	28 ft. 6 ins.

As compared with other large English docks the following dimensions are given:

	Length on floor. ft.	Width of entrance. ft.	Depth on sill, high water. ft.
Glasgow, No. 2	880	83	26½
Southampton	750	87½	29½
Belfast (Alexandria)	825	80	25¾
Birkenhead, No. 2	750	85	26¾
Portsmouth, No. 15	550	94	33¾

The Glasgow dock is divided by a pair of steel gates into two divisions of 460 and 420 ft., respectively. The purpose is to reduce the volume of filling and pumping out, as the outer division takes the average vessel using the dock.

THE PROPOSED NEW CHARTER FOR THE CITY OF San Francisco, abstracted and commented on in our last issue, is reported as having been adopted by a majority of about 2,000 at the election on May 26. The state legislature of 1899 must yet pass upon the charter.

CROPS ON THE SEWAGE FILTER BEDS AT Altoona, Pa., are to be raised this year by Mr. M. V. Ormer, who is to pay $100 for the privilege of cultivating an area of 56.8 acres. The rainy weather has delayed the work. The crops will include oats, corn, potatoes, cabbages, onions and peas. Three bids were received for this privilege, two men offering $100 and one offering $3 per acre, or $170. The contract was awarded to the latter, but he failed to furnish the required bond of $500, so the award was made to Mr. Ormer. A record of the dosing of these beds during the last five months of 1897 shows that on the average each of the 36 beds received sewage for 308 hours, which disappeared in 110 hours after the flow was stopped. Some of the beds were not used the whole of the time, the average time in use being 129 days, during 19 of which the beds were wet (sewage being applied or not having disappeared), leaving 110 days on which the beds were dry. The exact amount of sewage treated is not known, but is estimated at 60 gallons per day for 13,000 people, or 780,000 gallons. The total area of the beds, including embankments, is 64.469 acres, an average of 1.791 acres per bed. The level area adapted to cultivation is, as given above, 56.8 acres. We are indebted to Mr. Harvey Linton, M. Am. Soc. C. E., City Engineer of Altoona, for the above information.

OYSTERS AS A MEANS OF CONVEYING TYPHOID fever have again come to the front, this time in England. According to "The Surveyor," Dr. G. S. Buchanan has made a report to the Local Government Board in which he traces 26 cases of typhoid fever, in six sanitary districts of Essex and Suffolk, to the use of oysters exposed to sewage from the outfall sewers of Brightlingsea.

DOUBLE INTERMITTENT FILTRATION THROUGH coke breeze, preceded by the passage of the sewage through screens of fine mesh, has been recommended for the sewage of Columbus, O., by Mr. John W. Alvord, M. Am. Soc. C. E., Consulting Engineer of Chicago, in collaboration with Mr. Julian Griggs, City Engineer of Columbus. A total filtering area of 36 acres is proposed, divided equally between beds of fine and coarse grain, each bed to have an area of one acre. The estimated cost of the purification plant, including land, is $508,600, of which about $330,000 is for the filter beds. The estimated amount of sewage to be treated is 15,000,000 gallons ordinarily, with 20,000,000 gallons as a maximum. The operating expenses, interest and depreciation, together with the cost of pumping, are estimated as amounting to $36,973 a year, of which $25,000 is for labor and material at the beds. It is suggested that two beds be constructed and carefully studied for one season under the direction of a competent chemist before proceeding further. The report of the above engineers also includes recommendations for improvements to the general sewerage system and the construction of a pumping plant, made necessary if the sewage is to be purified. The estimated cost of this work is $418,028.

THE PORT ARTHUR SHIP CANAL has been visited by a committee from Galveston, Texas, and this committee reports as follows: The ship canal is completed to a 16-ft. depth for 3½ miles, out of the total 7 miles. When the whole is completed to this depth the dredges will then cut down to the 24-ft. level. Three dredges are at work and they expect to finish the 16-ft. cut by Oct. 1 next.

THE LAKE CHAMPLAIN AND ST. LAWRENCE ship canal was incorporated in the Ontario Parliament on May 26. This company, with $6,000,000 capital, proposes to build a canal from Montreal to Lake Champlain, on a route endorsed by the deep waterways commission. The government is empowered to take over the enterprise at any time, on 30 days' notice. Among the incorporators are J. Wesley Allison and Charles F. Burgh, of New York, and Hon. Smith W. Weed, of Plattsburg, N. Y.

THE INTERNATIONAL CONGRESS ON NAVIGATION will hold its seventh meeting at Brussels, July 25 to July 30, inclusive, 1898. Business will be conducted under separate sections, as before, and these sections are: Canalized rivers, inland canals, tidal rivers and ship canals, seaports, tolls. Excursions are proposed to Bruges, Heyst and Ostend, to Antwerp and to Liege. Reports will be made under all the sections by individuals appointed at the last Congress. Any one interested in the purposes of this meeting can attend, either as a delegate or in a private capacity, by forwarding the annual subscription of 25 francs ($5.00) to Mr. Dufourny, General Secretary, 38 Rue de Louvain, Brussels, Belgium. This subscription entitles him to copies of the valuable annual reports issued, in English, French or German, as desired.

THE NEW EAST RIVER BRIDGE, after work had been interrupted for some time, owing to the failure to provide necessary funds, now has a prospect of obtaining the needed appropriation. Since the new administration has been convinced that the city of New York is not in debt about $20,000,000, but really has a credit of $10,000,000 to her debt-creating power, some of this money is promised to the Bridge Commission. The amount wanted is about $4,000,000.

THE PROPOSED IRON BRIDGE OVER THE AMU-Daria River, on the Central Asian Railway, would replace a wooden bridge built when the Trans-Caspian Railway was built. The site is about 130 miles northeast of Merv. As the river overflows its banks the new bridge would be 13,887 ft., or almost three miles long, and 72 ft. above the normal water level, to keep clear of the drift coming down. The estimated total cost of the bridge is $2,500,000, and a Russian firm has secured the contract for the metal work. The bridge will probably be commenced this summer.

IMPROVEMENT OF THE DANUBE is to be continued by the European Commission of the Danube as follows: A 5-mile cut, 400 ft. wide and 20 ft. deep, is to convert the Sulina branch of the river into an almost straight waterway of 35 miles in length, from the Port of Sulina to the Tultcha branch of the main river. In 1856 the Sulina mouth was only 9 ft. deep; in 1862 this depth was increased to 17½ ft. by means of jetties; and in 1876 to 20½ ft. The present depth of 24 ft. is maintained by dredging. This Commission was created in 1856, as an outcome of the Treaty of Paris, to regulate the maritime portion of the Lower Danube, 100 miles in length, and at that time the Sulina branch was 46 miles long, crooked, filled with shoals and in places not more than 9 ft. deep. The annual overseas trade to the Danube only amounted to 450,000 tons in 1856; while in 1896 it was 1,800,000 tons.

A NEW AUTOMATIC MACHINE GUN.

Machine guns, that is, the smaller sizes, may be divided into two general classes: (1) Those depending upon positive mechanical devices operated by hand power, motors, or by the energy of recoil as stored in springs to work automatically the firing, ejecting and reloading mechanism, and (2) those employing the powder gases to do this work. So far the latter class has been somewhat uncertain in its operation, and, in any case, it is never used outside the smallest calibers. Recently the Colt's Fire Arms Mfg. Co., of Hartford, Conn., has placed upon the market a type of automatic gun, falling in the latter class, which warrants particular attention, especially at this time. The gun in question is known as the Browning, after its inventor. It is intended for the use of the army or navy, but will also find application in connection with police duties, and for mounting in mints, treasuries or similar places.

FIG. 1.—AUTOMATIC GUN MOUNTED ON TRIPOD, CARTRIDGE BOX ATTACHED READY FOR SERVICE.
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn., Makers.

Figs. 1 and 2 give a fair idea of the appearance of the gun with two of the several types of mounts. For cavalry service a light tripod is provided which can be carried in a cavalry boot on one side and the gun in the same way on the other side of the saddle. For fortification purposes a parapet mount is furnished, while for marine use a cone, bulkhead or landing carriages are provided, the latter shown in Fig. 2.

The weight of the outfit shown in Fig. 1 is: Gun 40 lbs., tripod 54 lbs., a total of 94 lbs.; as in Fig. 2, including field carriage, gun mount, ammunition chests, cartridge belts and feed boxes for 2,000 pounds, the weight is 230 lbs. For police use a fixture is furnished to attach to the side of the patrol wagon so that the gun can be mounted while responding to an emergency call.

Referring to Fig. 3, it will be noticed that the gun consists of a heavy barrel attached to a casing which contains all the operating mechanism. Towards the nozzle end is a small vent opening into the barrel, through which the confined gas from the explosion of the powder attempts to escape after the projectile has received its maximum velocity. In so doing the pressure acts upon a small piston which throws an operating lever, causing in turn suitable mechanism to eject the empty shell and place a new cartridge. Springs return the gas lever which forces the cartridge into the barrel, closes and locks the breech block and springs the hammer ready to be fired again. If the gun is empty, as in starting, the gas lever is first thrown by hand. When once started, however, the action is entirely automatic and the gun may be fired singly by pulling the trigger once or continuously by holding the trigger. In the latter case, between 400 and 500 shots can be fired per minute.

The cartridges are mounted upon a canvas belt which is coiled up in a box constructed to hang at the side of the gun so that any movement of the barrel in aiming will not affect the feeding mechanism. The boxes are made in three sizes, containing 100, 250 and 500 cartridges respectively. The gun can be constructed for any kind of rifle ammunition, the standard caliber for the U. S. navy being 6 mm. or 0.236 ins. Three other standard calibers are also made, 0.7 mm., 0.765 mm. and 0.8 mm. In all cases smokeless powder is required to prevent clogging, and the collection of residue in the barrel is obviated by constructing the hammer to act as a piston for an air pump which forces a jet of air through the barrel after the empty shell has been ejected.

To insure the greatest possible penetration nickel-jacketed bullets are used. These give an effective range varying from 1,960 ft. to 2,500 ft. and a penetration of 48 ins. to 60 ins. of pine, according to the caliber. To avoid accidents when a loaded cartridge is left in the barrel, a safety lock is provided, which prevents the hammer striking the firing pin.

The parts are few, simple, strong, and made of the best material, and are so designed that the main spring, firing pin, and other parts where there is any possibility of derangement, can all be easily and rapidly removed from the rear of the gun without loosening a single screw. The barrel is made unusually heavy, to give weight, prevent injury and obviate the usual water jacket.

The possibilities of such a gun, it can be seen, are great; it can be mounted in the bow of small boats, on horseback or in wagons, cars or the like, and with a small steel shield to protect the operator it can deliver a stream of bullets with remarkable accuracy, owing to the rigid mounting of the gun. The weight is so small, comparatively speaking, that one man, or two at most, can carry and operate it, thus making the gun nearly as portable as the common magazine rifle. A company of men, say two to each gun, armed with such weapons, and protected by intrenchments, could withstand the attack of almost any number of troops.

NOTES FROM THE N. Y. ELECTRICAL EXPOSITION.

The very fair attendance at the electrical exposition which has been held during the month of May, at the Madison Square Garden, New York city, is gratifying to those interested in electrical engineering and the electrical industries, as it must be to the managers of the exposition.

It furnishes evidence that the development of electrical apparatus and the constantly increasing application of the electrical current in every department of industry and in domestic life is of as great interest as ever to the public, upon whose patronage both the electrical manufacturer and engineer must in the end rely for profitable employment.

Of course, to many of the visitors to such an exhibition as that at the Garden, the exhibits are simply an array of "electrical things," and to that class the exhibition's duty is done when it impresses upon them the fact that electricity can be successfully and cheaply employed to furnish light of many kinds; to operate fans, motors and elevators; to cook, to heat and to refrigerate; to run boats, carriages and street cars; and to do a multitude of other tasks in the store or the office, the mill or the mine, the ship or the dwelling.

Of course, to the engineer, or to those engaged in almost any line of electrical manufacture, these things are for the most part commonplace. Those of this class who visit such expositions find their interest and profit in comparing different types of apparatus, noticing the general tendencies in design, the improvement along certain lines and the acme towards which these improvements point.

From this point of view there is much of interest to be seen under the great roof of Madison Square Garden. At the very outset the wide adaptability of electrical apparatus and the ease with which electical current is transmitted are strikingly illustrated. In the basement the boilers, engines and operating generators furnish specimens of isolated electric station equipment. The generators here and on the floor above are, with few exceptions, multipolar. There is a decided general resemblance in the appearance of the direct current machines exhibited, nearly all being direct-connected, with circular cast-iron or steel field frames, and 4, 6, 8, 10, or more inwardly projecting poles. The fields are compound wound. The drum armatures, are wound "barrel type" with large commutators and carbon brushes; a further specification of slow speed, would fit nine out of ten of the generators on exhibition. The care bestowed upon insulation, lamination and ventilation by the designers is also apparent.

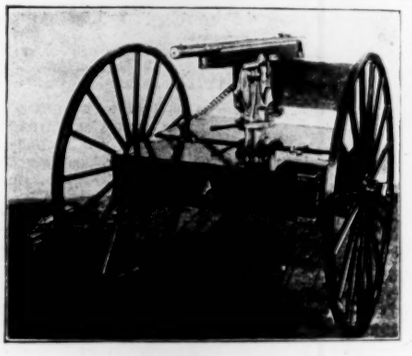


Fig 2.—Navy Type Mounted Automatic Gun for Landing Parties.

The same description applies to a large degree to the motors exhibited, although the service for which these are intended now plays a large part in their design. The proportions are very frequently altered to suit the lathes, planers, elevators, which the motor is to drive. Where a motor is intended for dangerous or out of the way places, it is often made iron clad or dust proof. The clumsy old style starting box or regulator has given place to enamel rheostats, packed card resistances or some form of series-parallel control, any of which is much more compact and sightly. Automatic cutouts for motors are now common practice on even the smaller sizes of starting boxes.

Switches and switchboard practice have passed through the experimental stage, and there is now a noticeable resemblance between the apparatus of the various companies. All employ some form of fireproof board or mounting, either slate, marble or glass. All fittings, such as bus-bars, feeder terminals, taps and switch parts, are now of copper, where formerly brass was extensively used. Knife switches even for the smaller sizes are now in general use, and the familiar encased snap switch, unless exception is made of the wall push button switch, has had its day. Quick-break knife switches and automatic circuit breakers are not

new, but an increasing use is evident. The old style cumbersome and inaccurate direct-connected instruments are no more, and in their place the neat, compact and more reliable shunt instruments are now placed on switchboards.

The many uses to which incandescent lamps are to-day put and the variety of shapes and colors of regular or miniature lamps, are a surprise even to many electrical engineers who examine such an exhibit as that at the Garden. A noticeable feature is the increasing voltage; 220-volt lamps have ceased to be a novelty, and even 500-volt lamps are beginning to be a commercial article. Arc lamps show surprising improvements. Incandescent arcs are increasing in popularity, and all classes of arcs are remarkably steady and satisfactory in operation. Sizes of lamp frames have been much reduced, and the clumsy, hissing, high tension lamp, at least for interior lighting, has given place to a remarkably compact, noiseless and safe type of enclosed lamp. One in particular, 12 ins. high, weighing about 3½ lbs., requiring only 2½ amperes, seems almost the perfection of arc lighting. The enclosed arc is the thing now, and open short-hour arcs exist only in very old forms of lamp. The possibilities of vacuum tube lighting, as shown in the Moore chapel, it must be admitted, give promise that we will eventually abandon both arc and incandescent lamps as we have the oil lamp and tallow dip.

Wireless telegraphy also seems to be assuming a position where it is worthy of practical attention, and its stand to-day may be likened to that of the telephone at the Centennial held at Philadelphia in 1876, only 22 years ago. It is hard to realize that telephony, and in fact, all the electrical arts, as shown at the Exhibition, are developments of the last quarter century. Looking forward a like period, and basing one's views upon the showing made at this and other recent exhibitions, we are at liberty to imagine vacuum tubes the common method of lighting, telegraph wires considerably fewer than at present, telephones in as common use as public water supplies, and similar great changes.

INCANDESCENT LIGHTING BY PETROLEUM.

A novel system of incandescent lighting, in which a mantle of the ordinary type is heated by a colorless flame of petroleum vapor, is now being developed by the George Washington Lighting Co., No. 1 Nassau St., New York. The company has leased a floor of a large factory building at 68 to 78 Flushing Ave., Brooklyn, N. Y., where a member of the staff of this journal recently met the inventor of the system, Mr. George Washington, and examined various forms of the apparatus in use and a machine shop engaged in getting them ready for the market. Mr. Washington is a young Belgian, of English descent, and it is said that his great-grandfather was a brother of the first president of the United States. Mr. Washington's father was an Englishman who went to Brussels many years ago, establishing a factory there for making dye-stuffs. He sent his son to the best schools of chemistry in Germany and France, and equipped a laboratory for him in Brussels, in which, while experimenting with kerosene oil as a source of power for motor carriages, he discovered that by vaporizing kerosene by heat, mixing the vapor with air, and heating the mixture, he could produce an intensely hot flame, which could be used most advantageously for illuminating purposes by using it to heat a mantle similar to the one used in the Welsbach gas light. The invention was developed in a practical form in Brussels, and a factory for manufacture of the lamps was established there, when Mr. Washington came to the United States, started an American company, and began work at the factory in Brooklyn.

Four U. S. patents have been taken out by Mr. Washington, viz.: Nos. 576,523 and 576,524, Feb. 2, 1897; 589,051, Aug. 31, and 593,257, Nov. 9, 1897. They apparently cover broadly the system of burning kerosene under an incandescent mantle, without a wick, by forcing the oil under pressure through a tube, in which it is heated by radiation from the mantle, injecting the heated and vaporized oil through an exceedingly small orifice into a chamber, where it is mixed with air, the mixture, also being heated by the heat from the lamp, being conveyed to the burner. The four patents have in all 29 claims, but claim 4 of patent No. 576,523 probably shows most clearly the scope of the invention and its most essential features. The claim reads as follows:

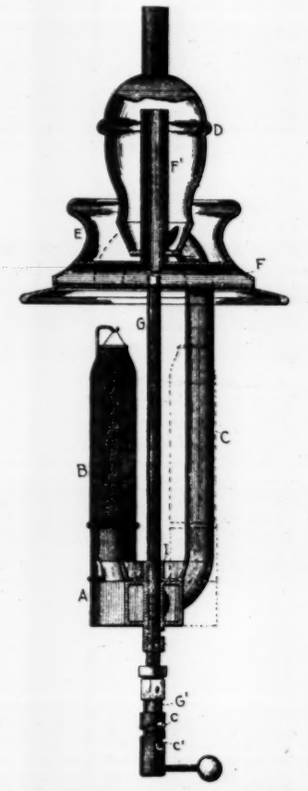


Fig. 1—Incandescent Petroleum Lamp. Made by the George Washington Lighting Co., No. 1 Nassau St., New York.

In a hydrocarbon incandescent lamp the combination with a vaporizing tube provided with a nozzle and needle-valve for controlling the discharge of vapor and a mixing chamber for receiving and mixing air and vapor, of an incandescent burner arranged and adapted to impart its radiated heat directly to the vaporizing tube and also to the mixed air and vapor as it flows to the burner, substantially as set forth.

The apparatus is capable of a variety of modifications, ranging from a lamp that may be set on a library table, the oil being contained in the body of the lamp, to an installation of a hundred or more lamps, of three or more burners each, the oil being fed from a tank at any convenient location through fine copper tubing. The tubing for carrying the oil is no larger than the insulated wire used for domestic electric lighting, and it may be strung around a room just as wires are strung. We illustrate herewith one of the forms of lamp, and also one of the forms of needle-valve. The tube G, Fig. 1, receives the oil under pressure from an external feed pipe, which is attached near its lower end to a T coupling. At the upper extremity of the tube G there is a very small hole, which is closed by a needle-valve, the stem of which is inside of the tube. The valve stem is operated either by a ratchet wheel as shown in Fig. 2, or by a pin and spiral groove c c', Fig. 1. The oil passing up through the tube is heated by radiation from the incandescent mantle B, so that it escapes as vapor into the mixing tube F', drawing in air at the same time through the air pipes F F. The mixture of vapor and oil is further heated in the mixing chamber D and is carried down through the pipe C to the base A, which is provided with one or more burners. A hood E surmounts the mantles, which directs the current of hot air upwards and around the mixing chamber D.

The oil is forced to the lamp by any convenient means, but the one most used, probably, will be to force it upwards from a closed tank by means of compressed air furnished by a hand pump. In the case of the library lamp, with the storage of oil in the body of the lamp, the pressure of air is obtained by means of a common bicycle pump. The oil may also, of course, be fed by gravity.

The mantles used with the Washington light are of special manufacture, suited to the purpose, and are said to be more durable than the mantles used in gas lighting. They are rated at 500 c. p. each.

In regard to the cost of lighting by the Washington system, the only figures we have at present are those given in a circular published by the company, from which we quote as follows:

Comparative Tests.

10 burners.	Consumption per hr.	Candle power.	Cost of materials.	Cost, hr., cts.	Cost per hour for 100 c.p.
Washington*	¼ gal.	5,000	10 cts. gal.	2½	1-20 cts.
Welsbach	.30 cu.ft.	600	$1.25 pr M.	3¾	2 "
Ordinary gas	.35 cu.ft.	250	1.25 "	4⅜	1¾ "
Argand gas	.50 cu.ft.	300	1.25 "	6¼	2 "
Incand. electric	.55 watts	100	.20	10	6¼ "

	Candle power.	No. of mantles.	No. of hours.	Cost, cts.	Consumption.
Washington light*	5,000	10	1	2½	¼ gal.
	1,000	2	1	½	1-20 "
	1,000	3	10	5	½ "

*Comparing the Washington light with the only high candle power light, commercially practical, viz.: the electric arc, we find it costs, on an average, 40 cts. for the arc, and 2 cts. for the Washington light, both lamps burning an equal length of time.

The extraordinarily low cost of the Washington light as stated is almost beyond belief, and we do not vouch for the figures, but that the cost of light by this system ought to be much less than that of either gas or electric lighting seems highly probable. In gas lighting we have first the conversion of coal into gas by a wasteful process, then purifying and scrubbing it, and storing it in vast tanks, its distribution through long pipes, a great cost of labor in manufacture, distribution, repairs, collection of accounts, etc. In electric lighting we first generate steam power by fuel, then turn it into electricity, then convey the current over an expensive wiring system, and then turn it into light. In the Washington system kerosene, which already in the well-known central draft burner lamps gives a cheaper light for domestic purposes than either gas or electricity, is burned at a far higher temperature than is possible in any lamp using a wick, and the heat generated is turned into light by the mantle, a far more efficient light-giver than an ordinary oil or gas flame. In this system the fuel is conveyed to the point of consumption in the most simple

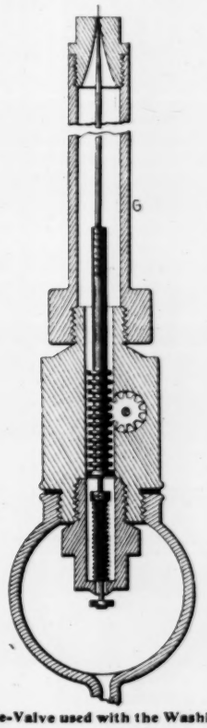


Fig. 2.—Needle-Valve used with the Washington Lamp.

manner possible, and is there burned and turned into light by a simple form of lamp. It appears not at all unlikely that the new light will become an important rival of gas and electric light.

A NEW WATER-TUBE BOILER.

We are indebted to The Brownell & Co., of Dayton, Ohio, for drawings of a new style of water-tube boiler which that company has recently placed on the market. It is called the "Johnston" boiler.

This boiler has a flat rectangular water leg connected at the top to one or more drums. Into the inclined side of the water leg are expanded the heating tubes. These tubes are each closed at the lower end by means of a box, which has a hand-hole and plate for closing it. This construction allows each tube to be free at one end, and obviates any strain caused by the unequal expansion of the tubes, which might occur if they were rigidly fastened at both ends. The water leg is divided into two chambers by a diaphragm. The inner circulating tubes pass through this diaphragm and communicate with the front chamber. The water passes down through these tubes and returning

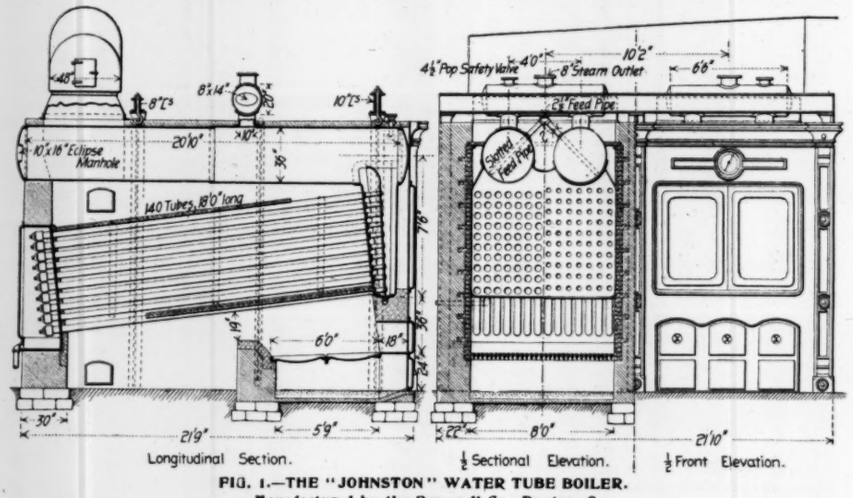


FIG. 1.—THE "JOHNSTON" WATER TUBE BOILER.
Manufactured by the Brownell Co., Dayton, O.

in the spaces between the heating and the circulating tubes, is discharged in the rear chamber of the water leg. The ascending and descending currents are thus kept separate, thereby preventing any interference and checking of the circulation, Fig. 1.

The sides of the water leg are braced with solid forged removable braces, fastened by means of pins, in double-jawed lugs, which are screwed into the sides of the leg and riveted over, as shown in Fig. 2.

The design of this boiler being so different in many particulars from that of any other boiler used in this country (although it resembles the Niclausse boiler, used in marine work in France), we desired the manufacturers to furnish some additional information concerning the operation of the boiler and to answer some questions which we thought might be raised in criticism of the boiler and of the claims made for it by the inventor.

Our first question related to the method of travel of the gases through the tubes, and to the possible disadvantage of the horizontal travel, due to the tendency of the gases to ascend and travel along the upper rows of tubes, leaving the lower rows unswept by the hot currents. The reply to this question is as follows

As regards the combustion in this boiler, we tried various arrangements of the tiling for deflecting the products of combustion through the tubes. Our first arrangement was the usual one, such as has been adopted by the Babcock & Wilcox Co., the Standard Co., etc., of passing the flame and products of combustion first up through the forward section of the tubes, then down through the central section and finally back up through the rear section. Analysis of the flue gases with this arrangement showed the presence of what we considered too much unconsumed combustible.

We then tried other arrangements and finally adopted that shown in Fig. 1, the lower row of tile being placed on the lowest row of tubes. With this arrangement we were able to obtain the most perfect combustion of any which we tried.

The point raised that the gases would travel along near the upper row of tubes and thereby leave the lower ones ineffective was one which occurred to us and which we really found to be the case with our first boilers, but which we have overcome as follows:

Our first arrangement of tubes was the staggered arrangement used by practically all the water-tube manufacturers. After seeing that the gases did travel mostly along the upper rows of tubes, it occurred to us that this might be obviated by arranging the tubes in vertical and horizontal rows. To break up the currents of the gases passing through the bank of tubes, deflecting tile were placed as shown on the accompanying drawing (Fig. 3). These tile not only cause the gases to pass around each tube, but also by reducing the area for the upward flow of gas by one-half, cause the gases to travel forward; in other words, baffle them from rising and thereby compel the gases to come in contact with the lower rows of tubes. The results of the new arrangement in practice have been most gratifying.

Our next question related to the cost of construction as compared with that of other water-tube boilers, and it was answered as follows:

As to the cost of this construction, this bracing can be done almost as cheaply as the fire-box of a locomotive boiler is braced with stay bolts. While an extra set of tubes is used, there is no rear water leg to construct, so that the boiler should not cost more than any other water-tube boiler upon which the same class of work is done.

Another question expressed a doubt as to the claims made for the boiler that it could easily be kept free from scale. The following is the reply:

Scale.—Instead of the scaling of the boiler being a weak point, we consider it, together with the excellent combustion, the very strongest point in the boiler. Consider for a moment the passage of the feed water through the boiler. The feed entering in the front side of the water leg being heavier than the water in boiler immediately falls, and is carried through the inner circulating tubes. Throughout the entire length of thus tube, 18 ft., this water is surrounded by the very hot water and steam which is returning through the annular space between the tubes. The result is that long before the water reaches the end of the tube it has become sufficiently heated to precipitate all the scale bearing salts contained in it, which are thus deposited in this inner tube, away from the heating surface. Consequently, what would in any ordinary boiler soon bake to a scale, is in this boiler left as a semi-fluid "sludge." By removing the hand hole plates at the lower end and inserting a hose in the front end, the tubes can all readily be washed out, requiring no scraping, no getting inside the boiler, and making altogether the easiest cleaned water-tube boiler in the market.

We claim for the "Johnston" boiler that the tubes will not scale, owing to the action explained above, and consequently the boiler will remain more economical, for long periods when using water containing impurities, than any other boiler. One of these boilers has been in operation alongside a return tubular boiler for the past fourteen months. The boilers both use the same water and all conditions are identical. The tubes to-day in the "Johnston" boiler are as clean and free from scale as the day they were put in, and never once has a scraper been put in them. The tubes in the tubular boiler are, on the other hand, covered with ¼-in. of scale. The water with which these boilers are fed is passed first through an ordinary open exhaust heater before being fed to boilers. This water contains about 22 grains of solid matter per U. S. gallon, the principal salts being carbonate of lime and carbonate of magnesia. If in the course of time the tube should scale, the inner tube can easily be removed through the hand hole in front head and the tube can be scraped as in any straight tube boiler.

We have been cited to a number of cases in which a tube within a tube has been tried and abandoned, but in

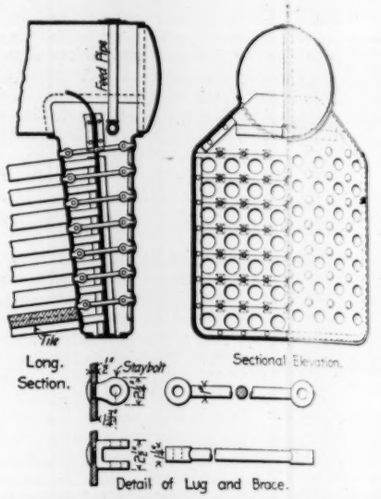


Fig. 2.—Water Leg of Johnston Boiler, Showing Method of Bracing.

every instance there have been good reasons why the device was not a success. Will say in this connection that boilers fitted with this type of tube are used almost exclusively for a class of work which is so trying that no other type of boiler has been able to give satisfaction, namely, fire engines.

We cannot say we are very well satisfied with this answer, and we believe the claim that the tubes will not scale is based on a rather limited

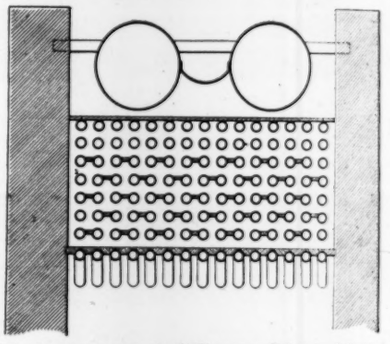


Fig. 3.—Arrangement of Tiles over Tubes in Johnston Boiler.

experience with bad water. We do not believe that a boiler ever was made which will not scale with some kinds of water used for boilers in the State of Ohio. We see no reason to doubt, however, that the boiler may be a very good one with good water or when provision is made to purify the water before allowing it to enter the boiler.

NOTES FROM THE ENGINEERING SCHOOLS.

West Virginia University.—A pamphlet has been issued containing the announcements for the summer quarter. This is not a "summer school," so called, but constitutes an integral part of the regular work of the University. All the departments are open during the summer, so that those who choose may devote the usual vacation season to study. A four years' engineering course may thus be taken in three years.

Cornell University.—Dr. Heinrich Ries, Ph. D. of Columbia, has been appointed instructor in economic geology. Dr. Ries is the clay specialist of the U. S. Geological Survey. He will conduct a course in economic geology for the civil engineers, a course on clays and building stones for architectural students, a course on the original nature of soil for students in forestry and agriculture, and an elective course in general economic geology.

Fig. 4. Transverse Section

Fig. 5. Longitudinal Section.

FIGS. 4 and 5. AMERICAN UNDERFEED STOKER.

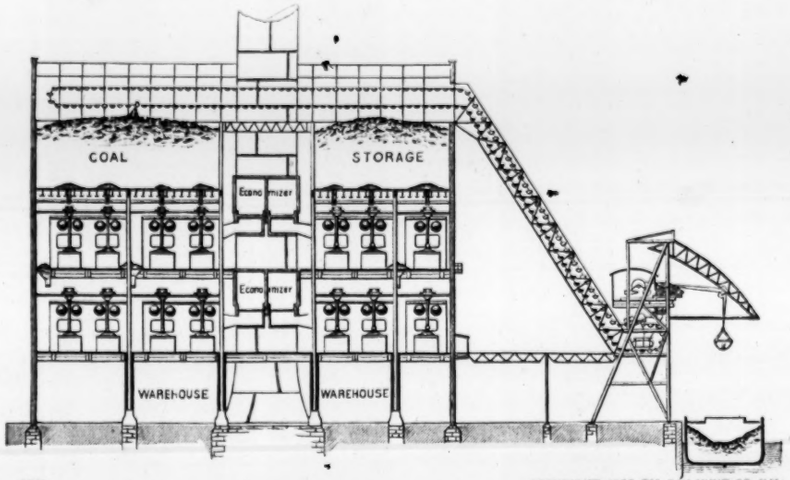


FIG. 6. DIAGRAM SHOWING ARRANGEMENT FOR HANDLING COAL.

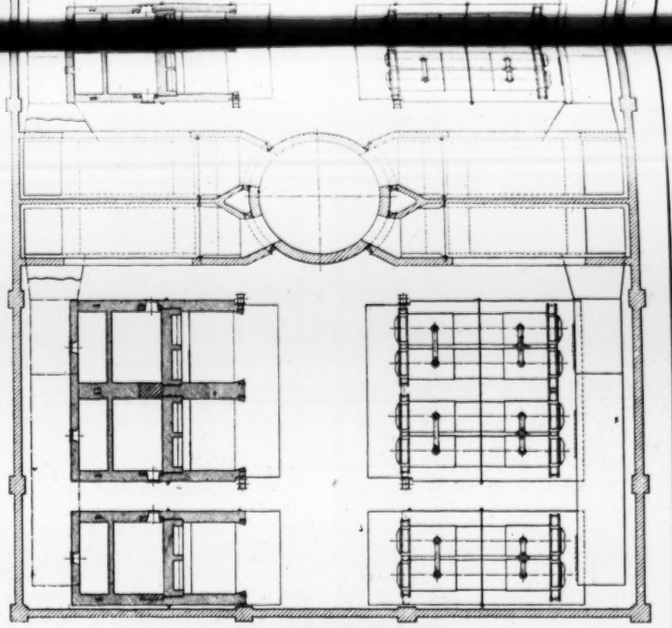


FIG. 3. GROUND PLAN OF BOILER ROOM.

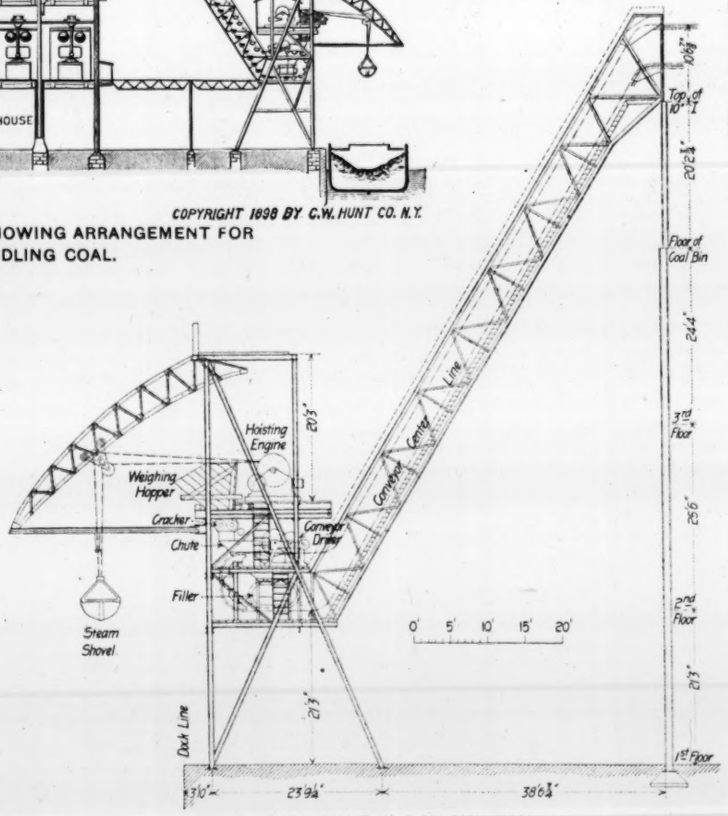


FIG. 7. COAL HANDLING MACHINERY.

BOILER HOUSE OF ARBUCKLE BROS. SUGAR REFINERY, BROOKLYN, N. Y.

Geo. M. Newhall Engineering Co., Philadelphia, Architect.

The Babcock & Wilcox Co., New York, Contractors for Boilers.

The C. W. Hunt Co., New York, Contractors for Coal Handling Machinery.

The American Stoker Co., Brooklyn, N. Y., Contractors for Automatic Stokers.

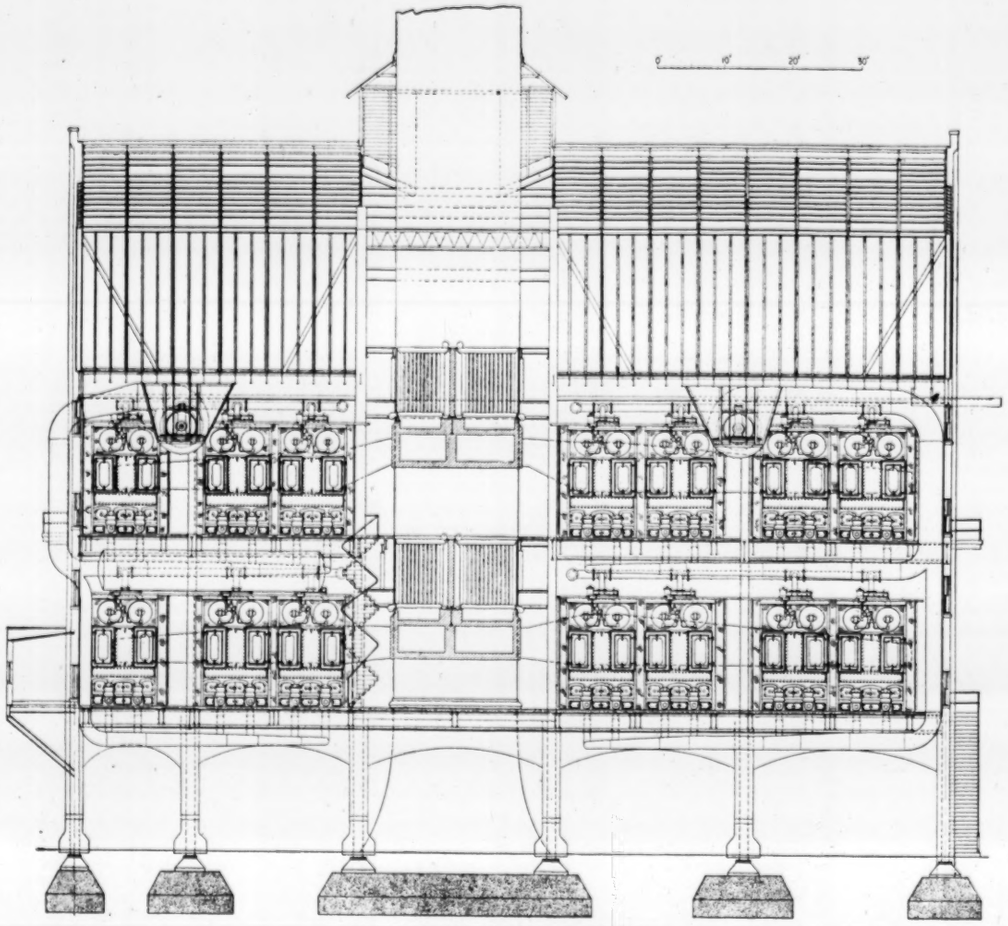


FIG. 1. LONGITUDINAL SECTION.

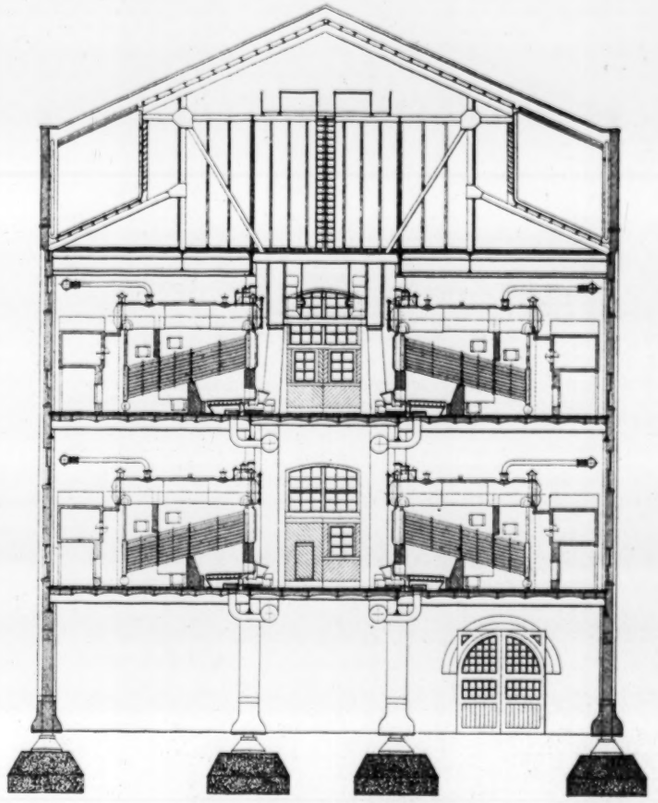
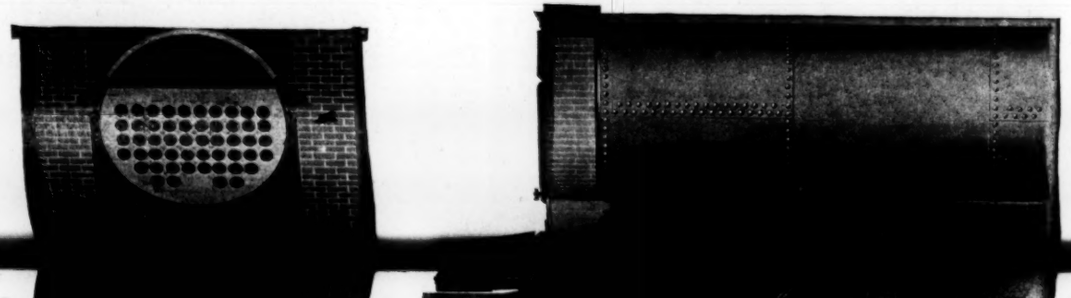
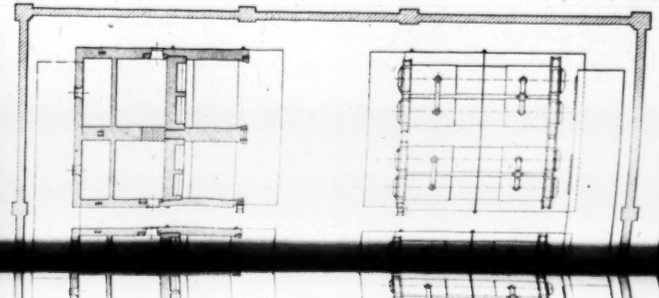


FIG. 2. TRANSVERSE SECTION.





PATENTS.*

By James W. See, M. Am. Soc. M. E.

There are certain matters connected with patents which are generally ignored by the text-book writers, and it is on these ignored matters that engineers and manufacturers, constantly in contact with the subject of patents, seem often to go astray.

The following remarks are designed to avoid discussion of controversial points; to be generally on the safer side in questionable matters; to deal only with questions on which inventive mechanics and manufacturers ought to be posted for purposes of every-day work with inventions; and to treat the subjects from the practical view of the shop, experimental room and office. The particular points herein considered may be briefed as follows:

Preliminary examinations are of merit in certain cases only.
Caveats are generally misunderstood.
Hurried applications are generally unwise.
Inventions are not easily stolen.
The first meritorious inventor prevails.
A patent is not a license.
Joint invention is often misunderstood.
Employers' rights are often misunderstood.
Change of purpose is not patentable.
Combination claims are good claims.
Aggregation is not invention.
Specific claims should supplement generic claims.
Sub-combinations are patentable.
The doctrine of mechanical equivalents inures to pioneers.
Modifications should not generally be set forth in patents.
Divisional applications are wise and often necessary.
A superior patent solicitor is not necessarily the best for all classes of cases.
The contingent fee system is generally but not necessarily bad.
Infringement cannot always be determined from the face of the patent.
The government cannot insure the validity of a patent.
Patent copies and digests are useful tools.
Foreign patents should be contemplated with caution.

Preliminary Examinations.

If an application is filed for a patent, it may become rejected on flat references which, if known in advance, might save the entire expense of the application. Some months generally elapse between the filing of the application and the reaching of it for official examination, the inventor during this time being in doubt as to where he stands and as to the advisability of spending money in promoting the invention. Hence the idea of a preliminary examination into the novelty of the invention. In some lines of invention it is possible to look up all of the patents in that line, and thus get a general notion of the prospects. If a flat anticipation is encountered, then the matter may be dropped. The expense of the preliminary examination is but a few dollars, and may be the means of saving the cost of an application and of promptly showing that no further hopes need be had.

But preliminary examinations are of respectable value only when they do succeed in bringing out such flat anticipations. If they do not develop anticipating matter it does not follow that the exhaustive official examination will not do so. No cheap preliminary examination can extend beyond United States patents, thus leaving foreign patents and literature and pending applications entirely unsearched, nor can preliminary examinations contemplate with any satisfactory degree of certainty the position which may be taken by the officials as regards questions, aside from novelty, of aggregation, non-invention, etc.

Preliminary examinations can be made only where the invention can be searched for in well defined classes. Where the invention is liable to be buried in non-cognate classes, or in an enormous number of classes, no reliable cheap examination can be made. Many cases occur in which it is impossible to say that anticipations of the invention should be looked for in certain classes of patents, and not elsewhere. For instance, a given detail of mechanism, invented with special reference to a steam-engine governor, might be found in connection with unthought of textile machinery, or a cord guiding device for a steam-engine indicator might be found fully anticipated in some patent for the rigging of ships.

Even where an invention might be searched for in well defined classes, slips may occur by reason of broken sets of patents in the portfolios of the Patent Office. It has often happened that a conscientious search through a given sub-class in the Patent Office has indicated a clear field, and that the subsequent official examination resulted in a flat reference, which belonged in that sub-class and belonged nowhere else. In other words, this reference should have been found during the preliminary examination. But it has developed that the portfolio was incomplete. It is the aim of the Patent Office to keep them complete and to surround them with reasonable safeguards; but rascally searches, with the desire to save the trifling cost of a copy of a patent, are able to abstract copies and leave the portfolios incomplete. These portfolios, altogether, contain over a half million patents, and there seems no reasonable way to insure their constant completeness. With a view to possibly saving the cost of an application, and with a view to prompt information on which to found hope or despair, it is advisable to make preliminary examination in case the invention will fit into fairly defined classes of patents, but not otherwise.

Caveats.

Many inventors seem to have a notion that a caveat is a provisional sort of a patent; that it constitutes title to property in inventions; and that it is a quick and cheap method for securing temporary protection. This is all wrong, for caveats fulfil none of these conditions.

It is advisable to have nothing to do with caveats, but to accomplish the caveat purposes by means of an application for a patent, for it is only in rare cases that matter can be described in a caveat which cannot be put into satisfactory provisional form for the purposes of a formal application. The preparation and filing of a caveat costs nearly as much as an application; its period is but one year without additional fees; it provokes no official examination, and therefore gives no notion of the prior state of the art, and it can never eventuate in a patent. A formal application, made for mere caveat purposes, costs but little more than the caveat; it provokes an official examination into the state of the art, and this serves to indicate whether or not its subject matter is new and patentable; it brings about the same notice and interference proceedings with any competing applicant, regardless of whether the competing application is earlier or later than the application in question; the application may be caused to eventuate in a patent if the matter is patentable and in satisfactory form; the application can be delayed within reasonable limits while the invention is being perfected, or in the end the application may be abandoned in favor of a later application for the invention in its more perfected form. An application has a further advantage in the fact that in case of interference proceedings it may give the applicant the benefit of the senior date of filing and thus throw burdens of opening proofs upon his competitor, while in the case of an application following notice under a caveat the caveator's application is bound to be of junior date. Briefly, a caveat does nothing that an application does not do, and an application does much that a caveat cannot do.

Hurried Applications.

Many inventors produce an invention and then seek a patent without delay, the result often being that the invention is patented in half-baked condition and must be followed up by later patents on more perfected forms, and that commercial experience may prove the invention a failure, and often the premature application results in such exposures as will preclude the later getting of patents with claims of adequate scope. The only advantage of the prompt application is that it enables an inventor to ascertain whether or not he is working in an old field. An application filed merely for the purpose of ascertaining the state of the prior art had often better be allowed to slumber while the invention is being mechanically and commercially developed. An inventor loses none of his rights by delaying his application for a patent. The law gives the inventor a period not exceeding two years in which to publicly exploit his invention before applying for his patent. He may sell the patented invention by the thousands without affecting his rights to the patent, so long as he applies for it within two years from its first publication by print or sale. During this period he may test the market and may improve his invention, and when he applies for his patent he may cover the invention in an approved form. Furthermore, the effect of the delay has been to give a later date to the patent, thus prolonging the date of its expiration nearly two years. If infringements develop during the period in question, then it may become advisable to avoid further delay in applying for the patent.

An exception should be noted regarding this matter of delaying the application. There is a class of inventions which might be called bubble inventions, or those which will sell for a short time only. Toys and advertising devices often come under this head. Such an invention, if put upon the market without patent, might provoke enterprising competitors having superior facilities and capable of getting all of the cream off of the business before the patent could be procured. Such inventions should be patented before they are exploited. Briefly, get the patent as quickly as possible if the commercial life of the invention is likely to be a short one, but otherwise delay the application, within the two-year period of exploitation, with a view to having the patent embody developed improvements, and with a view to prolonging the protected period.

Stealing Inventions.

Ideas can be stolen from the originator. But there is no excuse for inventions being stolen. An idea is not an invention, but is merely a hopeful conception of a possibility. The invention is the possibility reduced to form. Many men have ideas which are mere visions and which never can be given form by anybody; other men have ideas which they would be incapable of reducing to form themselves, but which could be reduced to form by others if the idea was disclosed. The mere hint or idea is of no benefit to the public, and is not the thing which the law seeks to reward. The useful invention is the thing which is recognized. It is quite common, when a meritorious inventor has gotten his patent, to hear numerous men say, "He stole that from me," when the fact was there was nothing to steal, no invention but merely an idea. The law rewards him who accomplishes something instead of him who merely suggests the desirability of a certain accomplishment. Regardless of who first conceives of the desirability of an invention, he who actually makes the invention first is the one entitled to a reward. If the inventor of an idea does not wish to be beaten out of the reward let him keep the idea secret and act upon it, and, if a competitor appears to exist, diligence must be shown in order to prevail against the competitor. The idea of an invention, followed by occasional and half-hearted attempts to reduce the thing to the form of an invention will not prevail against the meritorious inventor who, though later to conceive, or even borrowing the idea, was the first to reach the goal of practical accomplishment which benefits the world.

But if an inventor has gone further than the idea, and has developed it into an invention, then the only way he can lose his rights is to keep it secret, so that he cannot prove that he had any rights. The originator of an invention, who has reduced it to an actual useful invention, and can prove that fact, cannot be deprived of his rights. A competing inventor may meet him in the patent office with an application, or the competing inventor may actually get his patent before the meritorious inventor has applied for his patent, but if the facts are susceptible of proof, the meritorious inventor, after proper interference proceedings, will be adjudged his rights and will get his patent, and the patent of his competitor will be practically void.

Briefly, then, keep ideas of invention secret, for fear a more enterprising man acting on that idea may be the first to actually evolve an invention from it; be not so secret as to exclude knowledge from friends who may be needed to make proof of dates and diligence; be diligent in reducing an idea to a practical invention; when the idea is reduced to a practical invention avoid secrecy so as to have ample proof of the fact.

First Inventor.

In conflicts between interfering inventors, both seeking a patent on the same invention, he is the first inventor and entitled to the patent who has best done his duty by the public whose reward he seeks. The duty cannot be measured by any fixed standard, and each case must stand largely on its own merit. If an inventor has been diligent in pushing his conceived invention forward into a condition where it is in a position to advance the useful arts, he is not to be deprived of his reward by dilatory earlier conceivers, who have gone only so far as mere disclosures or sketches or drawings, or abandoned experiments or abandoned caveats. Priority of conception must be coupled with reasonable diligence. If there is no negligence on the part of the first inventor, the second inventor, though the first to reduce the invention to practice, will not prevail. An application for a patent is construed in law to be a reduction to practice. The first inventor is, therefore, either he who first conceives the invention and follows it up with reasonable diligence, or he who conceives later than a negligent inventor and first reduces the invention to practice.

A Patent is Not a License.

Many manufacturers labor under the mistaken impression that if they patent some new machine they are therefore free from the possibility of infringing on other patents. It is astonishing how common this error is, and how many manufacturers are in a hurry to get a patent, in order that they "may make the thing without danger from others." An original and meritorious patented invention may be dominated by some previous patent. A patented invention may be improved by a subsequent inventor, and most inventions are improved from time to time, but the improver acquires no rights under the fundamental patent by reason of having improved the fundamental invention. You cannot put your saddle on another man's horse, and thereby claim the right to ride that horse.

Further, the inventor of the improvement, having exercised the talent of invention and having advanced the useful arts, is just as much entitled to a patent for his improvement as the fundamental inventor was for his fundamental invention. It might be asked if it was not folly to patent an improvement which could not be used in view of a dominating patent. The answer is that improvement patents are often as valuable as fundamental patents, by reason of their expanding the market for the fundamental invention by increasing its capacity or lessening its cost. It is true that the owner of the fundamental patent may be the only possible customer for the improvement patent, but it often happens that the improvement is important or even essential to the financial success of the fundamental invention. Again, it may develop, in course of time, that the fundamental patent is invalid for some reason, and in any event the fundamental patent will expire while the improvement patent is in force.

Joint Inventors.

Where an invention is the result of the joint efforts of two or more parties, all the inventors must join in applying for the patent. Where an invention is the result of the effort of a single inventor he should not join with him anyone who has merely exercised mechanical skill in carrying out his instructions in developing the invention, or anyone who has joined him in a financial or proprietary capacity. In case the skilled mechanic has been

*Condensed from a paper presented at the Niagara Falls meeting of the American Society of Mechanical Engineers.

called on by the inventor in developing his invention, and a doubt arises as to whether or not the skilled mechanic has or has not exercised some act of invention, doubts should be resolved in favor of the skilled mechanic having done so, and he should join in the application, the fundamental inventor securing himself by proper preliminary contract with the mechanic, and by deed of assignment under the application. Questions of personal pride in connection with patents should always give way to legal considerations of the validity of patents.

Employers' Rights.

An invention, to be patented, must be applied for by the actual inventor, and in the absence of acts constituting a transfer, the patent, and all legal ownership in it, and all rights under it, go exclusively to the inventor. In the absence of express or implied contract a mere employer of the inventor has no rights under the patent. Only contracts or assignments give to the employer, or to anyone else, a license or a partial or entire ownership in the patent.

Where men employ people of ingenious talent, with the understanding that the results of such talent developed during the employment shall inure to the benefit of the employer, there is only one safeguard and that is to found the employment on a contract unmistakably setting forth the understanding.

New Purpose.

If an invention is old, it is old regardless of any new purpose to which it is put. It is no invention to put a machine to a new use. If an inventor contrives a meritorious machine for the production of coins or medals, his invention is lacking in novelty if it should appear that such a machine had before been designed as a soap press, and this fact is not altered by any merely structural or formal difference, such as difference in power or strength, due to the difference in duty. The invention resides in the machine and not in the use of it. If the soap press is covered by an existing patent, that patent is infringed by a machine embodying that invention, regardless of whether the infringing machine be used for pressing soap or silver. It is no invention to discover some new capacity in an old invention. An inventor is entitled to all the capacities of his invention.

Combination Claims.

Many people have an erroneous notion regarding patent claims, and consider the expression "combination" as an element of weakness. The fact is, that all mechanical claims that are good for anything are combination claims. No claim for an individual mechanical element has come under my notice for many years, and I doubt if a new mechanical element has been lately invented. All claims resolve themselves into combinations, whether so expressed or not. Combination does not necessarily imply separateness of elements. The improved carpet tack is after all but a peculiar combination of body and head and barbs.

The erroneous public contempt for combination claims is based upon the legal maxim, that if you break the combination you avoid the claim and escape infringement, and this legal maxim should be well understood in formulating the claims. If the claim calls for five elements and the competitor can omit one of the elements, he escapes infringement. Therefore, the claim is good only when it recites no elements which are not essential. Many inventors labor under the delusion that a claim is strong in proportion to the extent of its array of elements. The exact opposite is the truth, and that claim is the strongest which recites the fewest number of elements.

It is the duty of the inventor to analyze his invention and know what is and what is not essential to its realization. It is the duty of the patent solicitor to sift out the essential from the non-essential, and to draft claims covering broad combinations involving only essential elements. Sometimes the inventor will help him in this matter, but quite as often he will, through ignorance, hinder him and combat him. The invention having been carefully analyzed and reduced to its prime factors, and the claim having been provided to comprise a combination involving no element which is not essential to a realization of the invention, a new and more important question arises. The elements have been recited in terms fitted to the example of the invention thus far developed. The combination is broadly stated, but the terms of the elements are limiting. Cannot some ingenious infringer realize the invention by a similar combination escaping the literalism of the terms of the elements. It is at this stage that the claim must be carefully studied. The inventor, or some one for him, must assume the position of a pirate, and set his wits to work to contrive an organization realizing the invention but escaping the terms of the proposed claim. When such an escaping device is schemed out, then the defect in the claim is developed and the claim must be redrawn.

In this way every possible escape must be studied so as to secure to the inventor adequate protection for his invention. Solicitors find it difficult to get inventors to do this or consider this matter properly, inventors being too often inclined to disparage alternative constructions, the matter being largely one of sentiment founded on the love of offspring. The wise inventor will recognize the fact that the patent which he proposes to get is the deed to valuable property; that the object of the deed is not to permit him to enter upon the property, for he can do that without the deed, but that it is to keep strangers from entering upon the property; that he desires to enjoy his invention without unauthorized competition; that when the property begins to yield profit it will invite competition; that competitors may make machines worse than or as good as or better than his; and that he can get adequate protection only in a claim which would bar poorer as well as better machines embodying his invention.

Briefly, then, all good claims for mechanism are combination claims; the fewer the elements recited the stronger will the claim be; non-essential elements weaken or destroy the claim; the claim should not be considered satisfactory so long as a way is seen for the escape of the ingenious pirate.

Combinations and Aggregations.

A given association of mechanical elements may be entirely new, but it does not follow that it forms a patentable association, for not all new things are patentable. If the new association is a combination it is patentable, but if it is a mere aggregation it is unpatentable. An association may be new and still all of its separate elements may be old, the act of invention lying in the fact that the elements have been so associated with relation to each other as to bring about an improved result, or an improved means for an old result. All new machines are, after all, composed of old elements. The law presupposes that the elements are old, and that the invention resides in the peculiar association of them. An aggregation is unpatentable. As an illustration, a heavy marble statue of Jupiter is found difficult to move. Ordinary castors are put under its pedestal, and it becomes easier to move. Suppose castors were never before associated with a statue of Jupiter. Here is a new association, but it is a mere aggregation. The statue of Jupiter has been unmodified by the presence of the castors, and the castors act precisely the same under the statue of Jupiter that they did under the bedstead. There is no combined result, and there is no patentable combination.

But if an inventor takes a given mechanical element for the purpose of its well recognized capacity, and then associates with it another mechanical element for its recognized capacity, but so associates the two elements that one has a modifying effect upin the capacity of the other element, then the association will be capable of a result greater than the sum of the results for the individual elements. This excessive result is not due to the individual elements, but to the combination of them. One has been added to one and a sum greater than two has been secured.

Genera and Species.

An inventor, being the first to produce a given organization, and desiring to patent it, may see at once a patentable variation on the device. In other words, he makes two machines patentably different, but both embodying his main invention. He drafts his broad patent claim to cover both machines. In his patent he must illustrate his invention, and he accordingly shows in the drawings the preferred machine. The two machines represent two species of his generic invention, and for illustration he selects the preferable species. He drafts his generic claim to cover both species, and he follows this with a specific claim relating to the selected species.

The question might be asked, if the broad generic claim covers the selected and all other species, why bother with the specific claim, why not rest on the generic claim. The answer is that it might in the future develop that the genus was old, and that the generic claim was invalid, while the specific claim would still be good. The infringer of the specific claim may thus be held notwithstanding the generic claim becomes void. The inventor, however, cannot claim his second species in his patent. He can claim the genus, and he can claim one species under that genus, but all other species must be covered in separate patents. It is even unwise to illustrate alternative species in a patent for, in case of litigation, some one of the alternative species might prove to be old. This would have the effect, of course, to destroy the generic claim, but it might possibly have the effect of damaging the specific claim also if it should appear that the specific claim was after all merely for a modification as distinguished from a distinct species. Were it not for the danger of broad generic claims being rendered void by discovered anticipations, there would be no need for claiming species, but in view of such possibility it is important to claim one species in the generic patent, and to protect alternative species by other patents.

Combination and Sub-Combination.

A given machine capable of a given ultimate result having been invented, a claim may be drawn to cover the combination of elements comprised in the machine. Such claim will cover the machine as a whole. But, the fact being recognized that many machines are, after all, composed of a series of sub-machines, and that these sub-machines, in turn, are composed of certain combinations of elements, and that within these sub-machines there are still minor combination of elements capable of producing useful mechanical results, and that the sub-machines, or some of the subordinate combinations of elements within the sub-machines, might be capable of utilization in other situations than that comprehended by the main machine, it becomes important that the inventor be protected regarding the sub-machines and the minor useful combinations. Claims may be drawn for the combination constituting the main machine, other claims may be drawn for the combinations constituting the operative sub-machines, and claims may be drawn covering the minor useful combinations of elements found within the sub-machines. Each claimed combination must be operative. But secondary claims cannot be made for sub-machines or sub-combinations which are for divisional matter or matter which should be made the subject of separate patents.

Mechanical Equivalents.

Where an inventor produces a new mechanical device for the production of a certain result, he can often see in advance that various modifications of it can be made to bring about the same result; and even if he does not see it, he may in the future find competitors getting at the result by a different construction. He analyzes the competing structure, and determines that "it is the same thing only different," and wonders what the legal doctrine of mechanical equivalents means, and asks if he is not entitled to the benefits of that doctrine, so that this patent may dominate the competing machine.

An inventor may or may not be entitled to invoke the doctrine of mechanical equivalents, and the doctrine may or may not cause his patent to cover a given fancied infringement. If an inventor is a pioneer in a certain field, and is the first to produce an organization of mechanism by means of which a given result is produced, he is entitled to a claim whose breadth of language is commensurate with the improvement he has wrought in the art. He cannot claim functions or performance, but must limit his claim to mechanism, in other words, to the combination of elements which produces the new result. His claim recites those elements by name. If the new result cannot be produced by any other combination of elements, then, of course, no question will arise regarding infringement.

But it may be that a competitor contrives a device having some of the elements of the combination as called for by the claim, the remaining elements being omitted and substitutes provided. The competing device will thus not respond to the language of the claim. But the courts will deal liberally with the claim of the meritorious pioneer inventor, and will apply to it the doctrine of mechanical equivalents and will hold the claim to be infringed by a combination containing all of the elements recited in the claim, or containing some of them, and mechanical equivalents for the rest of them.

Were it not for this liberal doctrine the pioneer inventor could gather little fruit from his patent, for the patent could be avoided, perhaps, by the mere substitution of a wedge for the screw or lever, called for by the claim. The court, having ascertained from the prior art that the inventor is entitled to invoke the doctrine of equivalents, will proceed to ascertain if the substituted elements are real equivalents. A given omitted element will be considered in connection with its substitute element, and if the substitute element is found to be an element acting in substantially the same manner for the production of substantially the same individual result, and if it be found that the prior art has recognized the equivalency of the two individual elements, then the court will say that the substituted element is a mechanical equivalent of the omitted element, and that the two combinations are substantially the same. This reasoning must be applied to each of the omitted elements for which substitutes have been furnished. In this way justice can be done to the pioneer inventor. But the courts, in exercising liberality cannot do violence to the language of the claim. The infringer will not escape by merely substituting equivalents for recited elements, but he will escape if he omits a recited element and supplies no substitute, for the courts will not read out of a claim an element which no patentee has deliberately put into the claim, and a combination of a less number of elements than that recited in the claim is not the combination called for by the claim.

It is seldom that the exemplifying device of the pioneer inventor is a perfect one. Later developments and improvements by the original patentee, or by others, must be depended on to bring about perfection of structure. Those who improve the structure are as much entitled to patents upon their specific improvements in the device as was the original inventor entitled to his patent for the fundamental device. These improvers are secondary inventors, and are not entitled to invoke the doctrine of mechanical equivalents. The secondary inventor did not bring about a new result, but his patent was for new means for producing the old result. His patent is for this improvement in means, and his claim will be closely scrutinized in court, and he will be held to it, subject only to formal variations in structure.

The justice of thus restricting the claim of the secondary inventor must be obvious, in view of the fact that if the doctrine of mechanical equivalents were applied to his claim, then the fundamental device on which he improved would probably infringe upon it, which would be an absurdity. It is thus seen that the pioneer inventor may have a claim so broad in its terms that its terms cannot be escaped; that he may invoke the doctrine of equivalents and have his claim dominate structures not directly responding to the terms of the claim; that the secondary inventor, who improves only the means, is

limited to the recited means and cannot invoke the doctrine of equivalents.

But within this general view, sight is not to be lost of the fact that secondary inventors may be pioneers within certain limits. They are not the first to produce the broad ultimate result, but they may be pioneers in radically improving interior or sub-results, and they may thus reasonably ask for the application of the doctrine of equivalents to their claims within proper limits.

Modifications.

It frequently happens that an inventor, in applying for his patent, can show the preferred structure and lay the foundation for broad claims, while at the same time he can see various modifications capable of the same result. In such case the inventor is often desirous of illustrating such modifications in his patent, and patent solicitors often yield to the desire. It is generally unwise to illustrate and describe modifications. The claim should be of scope to cover the invention and mere modifications of it, regardless of whether those modifications are or are not set forth, and regardless of whether the inventor has conceived of them, so long as they are mere modifications. If he does show modifications, he might in court run up against a rule of law that were there is an enumeration the matter is limited to the enumeration. An infringement might employ a mere modification not comprehended by the enumeration.

Again, it is a maxim of law that a mere modification is comprehended by a claim. When the patent is taken into court, it might happen that some enumerated modification might be found to be old in the prior art, and in such case the claim would fall. If no modification was shown in the patent, then the patentee would be at liberty to deny that the given old device was a modification covered by his claim, thus possibly having his patent maintained for the structure shown in it. If the old modification was set forth, then the patentee could not deny that it was a mere modification of his invention, and that his so-called invention was a mere modification of the old device. Therefore, set forth only the preferred form of the invention, and depend on the scope of the claims.

Divisional Patents.

It may not be possible to cover the several segregable features of a given machine in a single patent. The law contemplates a patent for an invention and not for a number of inventions, and the classification of inventions in the Patent Office, and the organization of the examining bureaus, largely control in determining the matter of divisional applications. A bicycle may be invented which is new and patentable viewed as a whole structure. In such case the claim would recite all of the elements essentially involved in the new organization. But in this bicycle the pneumatic tire may of itself be new and patentable, and the wheel may be of a novel construction, and the lock-nut may be new, and the driving-chain may be new, and there may be a new means for securing the joints of the tubing.

These matters cannot be covered in one patent. The improved tire would be viewed as being entirely independent of the peculiarity of the bicycle, and would be susceptible of employment on other kinds of bicycles or vehicles; the wheel construction might be employed in other kinds of bicycles or in wheelbarrows; the chain might be employed in varying situations calling for the use of driving-chains. In the Patent Office the wheel of a bicycle is not treated as a bicycle wheel, but as a wheel, for any purpose for which it may be suited. A bicycle chain is not called a bicycle chain, and applications for patents on chains are not examined by the Examiner who examines bicycle applications. Lock-nuts constitute a sub-class by themselves.

The fact that the arts have recognized these separate subclasses of devices, and that the Patent Office classification of inventions deals with them as separate and independent elements in the arts, and that the examining divisions of the Patent Office deal exclusively with given matters—all these facts go to the merit of the question of division of application. The single patent can cover only such matters as are necessarily interrelated to each other. The patent on the bicycle can cover the improved lock-nut in its combination relationship to other features of the bicycle, but it cannot contain a claim covering the lock-nut by itself. The lines of division in the Patent Office are reasonable and necessary lines, and questions of doubt will, on review, generally be resolved in favor of the applicant. If the applicant can afford it he would be wise to resolve these doubts in favor of separate applications.

Solicitors.

Solicitors' fees cover the extended conferences or voluminous correspondence with the inventor; the preparation of the application; the prosecution of it in the Patent Office; the guarding of the inventor's interest in securing all that he is entitled to; and the delivery of the patent. The work is not to be measured by the complexity or simplicity of the invention. An improvement in carpet tacks might involve very much more legal work than an improvement in locomotives. The money value of an invention is often determinable by the merit of the patent granted upon it, and care should be used not to destroy the value of the property at the very start by getting the patent as cheaply as possible. The inventor sees but little of the actual work done by the patent solicitor, the real work being done generally after the application is filed in the Patent Office. It is then that the battle takes place, and it is then that the inventor's property is to be made good or bad. It does not follow that the highest-priced service is the best, but it is not likely that the best or even good service will be found at low price.

The selection of a solicitor by an inventor is often to be controlled by the character of the invention. Thus, a given invention may call for peculiar mechanical skill on the part of the solicitor. Most solicitors will be found competent to grasp most mechanical inventions, but a case occasionally arises where extraordinary mechanical skill is required in drawing distinctions between the new invention and its predecessor, the procuring of the patent thus depending very largely upon mechanical skill on the part of the solicitor. In such a case select a solicitor skilled in mechanics, or in the special branch of mechanics involved in the invention. Another invention may be simple in its device, but the question of obtaining the patent may depend entirely upon fine spun legal considerations. In such case the solicitor brilliant in the law and dull in mechanics might be the better man. Again, the brilliant mechanic and lawyer might be less preferable than a less talented solicitor in connection with a chemical case. Again, it is always desirable in important cases to have solicitors who have had experience in the particular line in question. Thus, for instance, if one has an important and complicated invention in textile machinery he would be wise to have a New England solicitor, or one who has had New England experience, for that section is the home of the textile arts of this country, and the solicitors of that section have had much more experience in this field than those of other sections. In metallurgy, and in machinery of the soil and harvest, the most competent solicitors would most likely be found in other sections.

For general purposes, however, it may be stated, that the competent solicitor can quickly get within his grasp the salient points of most any invention. If he has had proper training and experience the inventor will often be astonished at his capacity for tearing an invention into pieces, sifting out the chaff and getting right down to the kernel of the invention. Many inventors do not know what their invention is until advised by their solicitors. It is a mistake to suppose that the mechanic is a better solicitor than the lawyer. The lawyer's education is one of analysis, and any mechanic is a better mechanic after studying law. The patent solicitor must have a grasp of the law and of mechanics. He may be a lawyer who has studied mechanics, or he may be a mechanic who has studied law. But it is the legal training which fits the solicitor for quick grasp and thorough analysis.

Infringements.

A manufacturer, aware of possible infringement upon a given patent, may compare his proposed machine with the terms of the claim of the patent, and may find that his machine escapes the terms of the claim, but he will be quite in the dark as to his status until he becomes advised as to whether or not the state of the prior art was such as to prevent the patentee invoking such a liberal interpretation for his claims as would dominate the proposed structure. Bitter fights occur over questions of infringement, the same as they do over all other asserted titles to property. The inventor creates the new invention and gets his patent, and then may arise a conflict between him and the public; the public seeking to get around the terms of his claim, and he seeking to have its terms expended to dominate the fancied infringement.

If all inventors were pioneers in their lines, then justice could easily be measured out. But in the march of industrial development each inventor adds his mite, and his exclusive rights should be protected, but are often difficult to measure. An inventor may have fancied himself a pioneer and may have gone into the Patent Office with his application, making broad claims. Upon being rejected, in view of the state of the art, he cuts down the scope of his claims, and upon further rejection he cuts down the claims still more, and advances arguments showing delicate distinctions. He then gets his patent and often seeks to hold it over the heads of the public, as having considerable breadth of scope. It is here that the delicate duties of the court are called for in determining the proper limitations to the claim, and hotly contested facts and expert testimony become in order. The courts have referred to cases of this kind by likening certain patent claims to the nose of wax which is twisted one way to get the claim from the Patent Office, and then twisted the other way to make it reach and dominate an alleged infringement. Experts will always disagree over shadowy lines. The deed to real estate calls for land to the center of the river, but the river has long since dried up and geological experts may well differ over its former location.

Copies of Patents.

The government has printed copies of most all its issued patents, and manufacturers and others having to do with patents should more fully avail themselves of this fact. They would do well, if much concerned with patents, to have volumes containing copies of those of interest. The Patent Office divides inventions into something over two hundred classes, and these classes are again divided into sub-classes on more or less rational lines. There are over 6,000 of these sub-classes. The Patent Office will furnish free on application a classification list. Copies of single patents may be purchased for 5 cts. each; if a complete subclass is taken, for 3 cts. each; if a complete class is taken, 2 cts. each. Any person can procure these copies from the Patent Office at the above figures. The Patent Attorney would necessarily charge for services in ordering, or for any necessary service. The Patent Office will also enter subscriptions for the mailing of such patents as may issue from time to time in a selected sub-class, a small deposit being made and renewed to cover the cost at 5 cts. each.

Digests.

Over 600,000 United States patents have been issued, and it is unfortunate that the Patent Office has thus far not been able to procure appropriations for digesting them somewhat as the British Patent Office has partially done with its comparatively small number of patents. Such digests of United States patents as have thus far been published are the result of individual enterprise, and the works are necessarily expensive, owing to the great labor and the very limited demand. Manufacturers interested in specific lines of inventions would do well to avail themselves of such digests so far as suitable to their purposes. These digests have been the outgrowth of special activity in certain lines of industry at certain times. I have never seen a complete list of these digests, and do not know that one could be made, but I here append a list as complete as I can make it:

"Sewing Machine Attachments." By Geo. W. Gregory. 1872.
"Breach-Loading and Magazine Small Arms, Except Revolvers." By V. R. Stockbridge. 1876.
"Seeding Machines and Implements." By James T. Allen. 1878. With certain supplements since.
"Plows and Attachments." By James T. Allen. 1881.
"Agricultural Implements." By James T. Allen. 1884.
"Harrows and Diggers, Seeders and Planters, Cultivators, Harvesters." By James T. Allen. 1886.
"Cycles or Velocipedes, with Attachments." By James T. Allen. 1892. With certain supplements.
"Underground Lines." By James W. See. 1886.

Foreign Patents.

Good foreign patents are extremely valuable property, but it does not follow that all foreign patents are of value. Not one in a hundred of American inventions, even if they are somewhat profitable, are worth the cost and trouble of foreign patents. The cost of foreign patents is heavy, and in most cases the continued validity of the patents is contingent on the payment of taxes and the local working of the invention. If a customer is promptly found under the foreign patent, then its taxes and working offer few difficulties, but if no customer is found within a year it becomes a serious matter to perform the legal workings. Little or no confidence should be placed in nominal or paper workings, and even these are expensive. In some countries taxes begin and the invention must be worked at the end of the first year, and the working must not permanently cease; and in the case of Canada, the continued validity of the patent restricts the power to import the invention into Canada.

An invention which has made good profit in America and is a matter of foreign requirement is well worth foreign patents, and the customer may often be found in view of the American success. But the trouble is that the foreign patenting cannot be delayed until American success determines its expediency. In some foreign countries the patent would be rendered void by prior patenting or disclosure, and in America the patent expires with the term of the first expiring previously granted foreign patent. Hence, to avoid any ante-dating, all the patents should bear about even date. Date can be made for foreign patents by merely filing the application, while in America the date of patent is the date of grant, and may be months or even years after the date of application. Hence the proper course is to take no steps regarding foreign patents till the United States application is allowed. Then select the proper future issue day for the United States patent and cause all the foreign applications to be filed on that day. An exception is to be made in case the invention goes into public use before the issue of the United States patent. In such case the shortening of the life of the United States patent must be submitted to, and the foreign patents should be taken out before public disclosures would render them void.

In most foreign countries patents are granted as a matter of course, without examination into novelty, and the grant of the patent is no evidence whatever that the patent is good for anything. In Germany applications are examined, and generally rejected. The merit which will insure the grant of a German patent is not at all to be measured by American standards.

Briefly, then, waste no money on foreign patents unless prompt results are in sight, or unless the invention is of importance enough to justify the expense and trouble due to recurring taxes and legal local working of the invention; foreign patents should antedate invalidating disclosures of the invention; it is desirable that all patents on the same invention bear even date. This latter can be secured by filing the foreign patents in the interval between allowance and grant of the United States patent.

THE TRACK ELEVATION AT CHICAGO which is being blocked by the refusal of the Chicago & Alton R. R. to agree to the plans is not that at the 16th St. crossing, as stated in our issue of last week, but is just beyond that point. Southwest from 18th St. the tracks of the Chicago & Alton R. R., Illinois Central R. R. and Atchison, Topeka & Santa Fe Ry. are all parallel and close together, and these tracks are to be elevated. The plans have been agreed upon by the city and the two latter roads, but the former road wants the city to erect viaducts over the tracks. At the 16th St. crossing the Chicago & Alton R. R. is not an important factor, as it has only one or two tracks to be dealt with.

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We give considerable space in this issue to a valuable paper read at this week's meeting of the American Society of Mechanical Engineers on the subject of patents, a matter on which few engineers and manufacturers are as well informed as they should be. We do not mean by this that it is to be expected that the average civil or mechanical engineer should be a competent patent attorney; but there are a few simple facts relating to patents which every engineer, and, in fact, every intelligent business man ought to know. Many of these facts are laid down in Mr. See's paper; and we venture to say that any of our readers who are not already familiar with this subject will be well repaid by not only cursorily reading this paper, but by giving it such thorough study as will enable them to keep in memory the principal propositions which Mr. See lays down. It seems to us probable that this paper, notwithstanding the fact that it presents nothing new, but merely lays down some very elementary facts, well-known to every patent attorney worthy of the name, is likely to be of the most practical value to the members of the Society of Mechanical Engineers of any paper presented at the current meeting.

There is one matter relating to patents and inventions on which Mr. See touches, that seems to us deserving of more emphasis, and that is the very great importance of the reduction in price of printed copies of patents which was made some time ago, and the opportunity which it offers of studying the "state of the art" and the history of almost every possible invention. The question is all the time coming up in engineering, and in the manufacturing industries: Is this or that suggested improvement really new? The only way to give an approximate answer to this question (and it must be borne in mind that none but an approximate answer can ever be given) is to search the Patent Office records. Now the old way of making a search to see what prior patents existed in any given field was first to go to one of the few libraries having complete files of the "Official Gazette of the United States Patent Office." Then, beginning with the indexes to the annual volumes, it was necessary to search in them for patents granted in each year for the particular device in question, and also for any other device which might, perhaps, contain similar elements to those in the device whose novelty was in question. Having searched all the indexes from 1836, when the present numbered series began, and accumulated a formidable list of patents, the next step was to search for these various patents in the bound volumes of the "Gazette" itself, in which the claims and part of the drawings of every patent are printed, and see which of the patents on the list could be thrown out as of no interest in connection with the question under consideration. Copies of the patents still left on the list would then be purchased from the Patent Office, at a cost of 10 cts. each, or in case access could be had to the very few libraries in the country where bound volumes of the complete patents are preserved, they could be looked up there.

The labor involved in this process of preliminary examination was so enormous that for years it has been abandoned except by poor inventors with time but no money at their disposal, and by those who knew no better. It was cheaper by far in order to ascertain whether a device was really novel or not to prepare a formal application for a patent and send it to the Patent Office, which would act upon it in one to six months.

But the reduction in the price of printed copies of patents has made this old method of "preliminary search" obsolete. A pamphlet, published by the Patent Office and sold at 10 cts. per copy, contains a complete classification of all the subjects of invention, and should be in every engineer's library. Suppose it is desired to see whether some new device in connection with the continuous heating of trains by steam from the locomotive is old. Turning to the pamphlet above referred to, we find that this is under Class 126, Stoves and Furnaces, and that it is Sub-Class No. 129, under Heating Systems—Train—Steam; also that the number of patents issued to date in this sub-class is 117. Where all the patents in a sub-class are ordered, the price is only 3 cts. per copy. Thus by sending the sum of $3.51 to the Patent Office, this whole set of patents can be obtained, constituting a complete record of what has been accomplished in this field by every inventor who has thought enough of his work to obtain a United States patent.

Of course, it is not always easy to determine under exactly what sub-class a given device will be placed, and it is sometimes advisable to purchase the patents in two or three sub-classes. But it will almost always be found that the money thus spent is well spent. The information thus obtained may make it clear that a device is so far from novel that no patent of any value could be obtained, or may so enlighten an inventor as to what others working in the same field have done, that he will be able to put his own device in far better shape before putting it into use or applying for a patent upon it.

It is true, of course, that the present classification is by no means perfect, and that errors sometimes occur through the means pointed out in Mr. See's paper. On the other hand, any search, even that of the Patent Office examiners, is only approximate; and if the file of patents in the subclass to which an invention belongs is searched through without finding anticipations, there is a strong probability that the invention is novel.

Further, as we noted in our issue of May 12, the present Congress has done what the Patent Office authorities have long been pleading for, enacted a law permitting the Commissioner of Patents to thoroughly revise and perfect the official classification so as to greatly facilitate the work of the office and of those who do business with it.

The principal iron ore supply of the United States is about to be monopolized by Standard Oil methods, according to a wail in the Pittsburg "Post," from which we quote as follows:

> The independent or smaller iron ore producers in Northern Minnesota appear to be sharing the fate which came upon the independent oil producers years ago, and at the hands of the same master in monopoly building. The Rockefeller ore combination is drawing into its clutches all within reach, and if the railroads are not working with it through discriminating rates against the independent concerns, as they worked with the Rockefeller Standard oil conspiracy, many people in that section will have guessed wrongly. Speaking of the rapid absorption of the small concerns on the Mesaba range, a prominent Duluth miner says:
>
> "It means that some fine day the iron interests of the country will wake up and discover that there is not a mine to be had in Minnesota, and the furnace men will be buying ore of their strongest competitors. It means that the Carnegie-Oliver combination and the Minnesota Iron Co. propose to dictate to the iron interests of the United States and control absolutely the cheaply worked iron mines of Minnesota, the cheapest-worked properties on the planet. They will be in a position to put the price up or down to suit their purpose, which will ever be to extend their power over the production of ore. The railroads, knowing where their interests lie, are hand and glove with the Carnegie-Oliver people."

If the railroads are, as hinted by the "Post," discriminating against the independent ore producers, that is a wrong which should be remedied by the Interstate Commerce Commission, but in other respects the so-called monopolizing of the iron ore production of Minnesota by a few strong companies is only a step forward in economic progress, and one which is in the direction of cheapening the cost of steel to the public at large, and of enabling the steel makers to export a considerable part of their product in competition with England and Germany. The principal human cause which enables this country to export steel rails to-day is the work that has been done by the large companies in cheapening the cost of mining and transporting ore. Small mining corporations could never have gone to the expense of providing the magnificent ore handling machinery on the docks, and the fine railroad and vessel equipment which are now used and which are necessary to the furnishing of cheap iron ore to the furnaces. If the iron interests of the country are to "wake up and discover" anything, it will be that the iron interests, that is, the owners of steel rail, wire and sheet mills, are also owners of blast furnaces, of ore and coal mines, of coke ovens, of railroads, of lake vessels, and of docks. It is by combining the ownership of all these necessary parts of the iron manufacturing industry that an iron-making company is enabled to make and sell cheap steel and thus to become a benefactor to the public.

WHAT IS THE HEATING SURFACE OF A STEAM BOILER?*

It is a fact which is now generally understood by engineers and all who have to do with steam power plants, that the power of any boiler, or more accurately the amount of steam which it can furnish in a given time, depends first of all upon its area of heating surface. Of course the amount of steam which a square foot of heating surface will produce varies between very wide limits; and is affected by a multitude of conditions. It is also true that heating surface is no more essential than the means for supplying the heat—that is to say, a furnace of sufficient size and grate surface to burn the fuel, and draft sufficient to supply the furnace with the necessary air. The furnace and the chimney, however, are not necessarily parts of the boiler at all; their function is merely to supply the heat, and the function of the boiler proper is to transfer as much as possible of this heat to the water which it contains. Both the amount of heat which it can transfer in a given time and the proportion of the total heat generated which can be transferred vary with the area of the heating surface exposed. In other words, both the capacity and the economy of a steam boiler depend directly upon its area of heating surface.

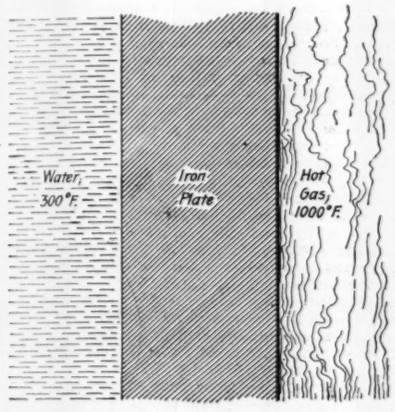
Evidently, then, the area of the heating surface of a boiler ought to be determined with a fair degree of accuracy. The designer of the boiler must know it, if, with any degree of precision, he is to adapt the boiler to the work which it has to do. The seller of boilers must know it, if he is to be sure of fulfilling his guarantees of capacity or economy; and the purchaser of boilers should know it in order to determine what he is getting for his money. As a matter of fact, a very large proportion of the boilers bought and sold are actually bought and sold by their heating surface. The price asked for and quoted may be the price per horse-power, but the horse-power is determined directly from the heating surface, the num-

*The substance of this editorial is presented by Mr. Charles Whiting Baker, of the editorial staff of this journal, in a paper read before the American Society of Mechanical Engineers at its meeting at Niagara Falls this week.

ber of square feet allowed to a horse-power varying from 5 to 14, according to the type of the boiler. Again, in comparing the work done by different boilers, the relative heating surface is always taken into consideration.

We need go no further for proof that accurate determination of boiler heating surface is a desirable thing. But we have now to notice the remarkable fact that in computing boiler heating surface, an error of from 7 to 17 per cent. is made by a large proportion of steam engineers and boiler manufacturers. The error to which we refer consists in taking the surface in contact with the water, instead of that exposed to the fire or hot gases, as the heating surface. If the heating surface is flat, of course the areas are the same, but boiler heating surface is in most cases made up of tubes, and the difference between the interior and exterior surface of a boiler tube is as much as 17 per cent. of the interior surface in the case of a 1-in. tube, and is about 7 per cent. in a 4-in. tube.

The error arises in the first place from a failure to appreciate the FACT THAT THE HEATING SURFACE EXPOSED TO THE FIRE IS THE ACTUAL HEATING SURFACE OF THE BOILER, ON WHICH ITS CAPACITY DEPENDS. A clear understanding of this fact is so important, and it has been and is so generally mistaken by engineers and writers of engineering works, that we venture to submit a discussion of the elementary principles on which this assertion is based.



In the accompanying cut, suppose we have an iron plate 1 in. thick, on one side of which is flowing a current of hot gas at a temperature of, let us say, 1000°, and on the other side is a body of water in a steam boiler at a temperature of 300° (corresponding to a gage pressure of steam of about 52 lbs.).

Now the heat in passing from the hot gas on the side of the plate to the water on the other meets with three different resistances, as follows:

(1) Resistance in passing from the gas to the surface of the plate.

(2) Resistance due to the passage through the plate.

(3) Resistance due to the passage from the other surface of the plate to the water.

That one of these resistances which is accurately known is (2) the resistance in the passage through the plate. The heat conductivity of metals has been carefully determined by experiment in physical laboratories, so that if we know the actual temperatures of the two surfaces of a plate and its thickness we can at once determine how much heat is passing through a unit area in a given time. On the other hand, if we know how much heat is passing through the plate, we can determine what is the difference of temperature of its two surfaces. Let us solve an example of the latter sort: Suppose the plate is transmitting heat enough to evaporate 3 lbs. of water per hour from and at 212° per square foot of its area, or about the average rate that the heating surface transmits heat in an ordinary stationary boiler. Since 965.7 heat units are required to transform a pound of water at 212° into steam at the same temperature, the plate will transmit $3 \times 965.7 = 2897.1$ heat units per square foot per hour, or for convenience let us say 2900 heat units.

Now experiments on the conductivity of metals have shown that an iron plate 1 ft. square and 1 in. thick whose opposite surfaces are kept at a uniform difference in temperature of 1° F. will transmit in an hour 473 British thermal units.* Hence to transmit 2900 B. T. U. per hour, the difference in temperature of the two sides of the plate will be $2900° \div 473 = 6.13°$.

It will doubtless surprise many to learn that so small a difference of temperature between the two surfaces of an iron plate is sufficient to cause so large an amount of heat to flow through it; but the coefficient for the heat conductivity of iron on which it is based is the result of many experiments by the most eminent physicists, and is accepted as correct by the best scientific authorities, and there is no reason to doubt its accuracy.†

In studying our present problem, however, the exact accuracy of the coefficient is a matter of no particular importance. We just found that boiler heating surface 1 in. thick, when transmitting 2900 h. u. per hour, will have a difference of temperature on its two sides of 6.13° F. But we never have heating surface of such thickness in steam boilers. The shell heating surface in externally fired boilers is seldom over ⅝-in. thick. Furnaces and fire boxes are made of ¼-in. to ⅜-in. plates, while tube heating surface is from 1-16 to ⅛-in. thick. We see, then, that the actual difference of temperature between the two surfaces of a boiler tube transmitting heat at the rate already named will be from ⅛ to 1-16 of 6.13°, or in round numbers from ⅜° to less than 1° F. As the eminent physicist Lord Kelvin has said, for all practical purposes we may consider that the heating surfaces of steam boilers conduct heat as if they were no thicker than paper, or as if the metal were of infinite conductivity. It will be seen also that an error of 50 per cent., or even of several hundred per cent., in determining the coefficient of conductivity of iron, even if such an error were probable, would make no practical difference in this conclusion.

There are many facts of practical importance to be drawn from this. For example, in its light we can readily see how little reason there is to expect any greater economy in locomotive boilers with brass or copper tubes and fire boxes than in those of steel. Yet we still hear the superior conductivity of copper urged as a reason why English railways stick to the use of copper fire boxes.

Turning again to the sectional view, we know now that the two surfaces of the plate (if we conceive its thickness reduced to that of an ordinary boiler tube), will have only a trifling difference of temperature. Next let us discuss the relative heat-absorbing powers of the water on the one side of the plate and the hot gases on the other. It is to be kept clearly in mind that the temperatures of the two sides of the plate which we have just considered are the temperatures of the skin of the plate itself, which is quite a different matter from the temperature of the air or the water in contact with the plate.

If this is clearly understood it will be easy to understand that the actual temperature of the plate itself depends on the relative heat-transmitting power of the fluids on its two sides. If these fluids were the same on the two sides, and were at the same temperature and under the same conditions as respects mobility, then the plate temperature would be a mean of the temperatures of the fluids on its two sides. But in the case shown in the cut, since water is many times as efficient as air or furnace gases in absorbing heat, the plate temperature will be nearly the same as that of the water, and far below the temperature of the hot gases.

This is a fact which is a matter of common knowledge; and yet it has been overlooked by many engineers and by engineering writers; and because it has been overlooked is one main reason why engineers have not always insisted on the fire side of tubes being considered the heating surface of steam boilers.

*See Ganot's "Physics," 13th ed., p. 378.

†Many engineering text-books and pocket-books still quote Rankine's formula and Peclet's coefficients for heat conductivity; but the latter have been found by the more careful research of modern physicists to have been largely in error.

Let us review some of the facts which show the relative heat-absorbing power of water and gases; Take an iron rod and heat it to redness, then let it be held still with only the air in contact with it, and see how long a time elapses before it is cool enough to be touched. Heat the rod to redness again and then plunge it in water, and again note the time before it can be touched. We have then a very rough approximation of the relative heat-absorbing powers of air and water.

Again, experiments have been conducted to determine the temperatures to which a metal plate could be heated when one side was in contact with water. The temperature was determined by inserting in it plugs of various fusible alloys, and the fire side of the plate was then subjected to the most intense heat that a powerful blow-pipe could produce. So long as the water side of the plate was clean it was impossible to melt the fusible plugs.*

The most striking illustration, however, which we have ever seen of the large heat-absorbing power of water, as compared with air, was an experiment conducted by a member of the staff of this journal some years ago. A vessel having a large vertical tube of about 2 ins. diameter was filled with cold water (45° to 50° F.); the hot gases from a large oil lamp or a Bunsen burner at a temperature of some 1000° or more were then passed up through the tube. The surface of the tube exposed to the hot gases was kept so cold by the water on the other side that drops of dew were condensed upon it from the hot gases, and the interior of the tube became actually coated with dew, which remained until the water was warmed to about 60°.

It is very easy to understand why water should have so much greater heat-absorbing power than air. The specific heats of water and air are as 1 to 0.23 for equal weights; but since air at ordinary temperatures weighs only 1-812 as much as an equal volume of water, if we consider a thin film of air in contact with a hot surface and a film of water of equal thickness and area in contact with a similar hot surface, the water would absorb 3,530 times as much heat as the air if the temperatures of each were raised an equal amount. Again, the relative heat conductivities of water and of air, according to Lord Kelvin, are as 40 to 1. On the other hand, in the transmission of heat from a surface to a fluid, the mobility among the particles of the fluid, whereby fresh portions of it are constantly brought in contact with the surface, is a matter of great importance, and in this respect air, of course, has a considerable advantage.

We know of no trustworthy figures for the relative heat-absorbing power of air and water; and the practical importance of their accurate determination may be trifling, for we know in a general way and from the examples already cited that water absorbs heat very many times more rapidly than air, so many times that in the case of a thin metal plate, such as a boiler tube, transmitting heat from furnace gases on the one side to water on the other, we can be quite certain that the temperature of the metal plate is at most only a few degrees warmer than the water in contact with it.

In other words, in any steam boiler with clean heating surfaces we can assume the temperature of the fire side of the heating surface to be practically the same as that of the water in the boiler. Perhaps it may be 1° more; perhaps it may in some cases be 20° or possibly 30° more. The difference is of no practical importance, since in the few cases where so large a difference as 20° or 30° may possibly exist the temperature of the fire to which the surface is exposed is greater by probably 2,000°, or more than the temperature of the plate.

If, now, it is clear that the fire side of the boiler tube or flue is at practically the same temperature

*It may be well to point out that this method of determining the maximum temperature reached by the plate is subject to more or less error on account of the obstruction to the passage of heat from the plug to the metal of the plate (the plug being merely imbedded in the surface of the plate and not passing entirely through it). Any joint between two metal surfaces interferes with heat conductivity just as it does with electrical conductivity. The amount of interference depends upon how intimate the contact is between the metals, the amount of oxide (if any) between them, etc.

as that of the water in the boiler, the reader will have little difficulty in comprehending that this surface, and not the surface on the water side, is the real heating surface of the boiler, which measures its capacity of making steam.

The great resistance to the flow of heat in any steam boiler is in getting the heat from the hot gases into the surface exposed to them. Compared with this, the resistance to the passage through the plate and the resistance to the passage from the plate into the water are mere trifles. If we increase the surface exposed to the hot gases we shall increase the capacity of the boiler to absorb heat; but if we leave this surface the same and increase the surface exposed to the water the amount of heat transmitted in a given time will be practically the same.

The case can be made still more clear, perhaps, by an analogy to the flow of water through pipes. If we have a length of 1-in. pipe connected to two lengths of 12-in. pipe, and allow water to flow through them under a head, it is clear that the flow will be determined by the resistance of the 1-in. pipe. If we enlarge that we shall enlarge the flow; but if we leave that alone and enlarge either or both the 12-in. pipes, the flow will be practically unchanged.

The area of the fire side of the tube is what determines the heat-absorbing power and the steam-making capacity of the boiler. If we can cause this to take up more heat in any way we shall increase the power of the boiler. The Serve tube, with its ribs extending into the hot gases, increases the interior surface of the tube, and thus its capacity for absorbing heat. If, however, instead of putting ribs on the fire side of the tubes, we put them on the water side, we increase the surface exposed to the water, but we make no increase of any practical importance in the amount of heat transmitted. In a similar way, the curved form of the tube, which causes the surface exposed to the water to be greater than that exposed to the fire (in fire-tube boilers), effects no increase in the amount of heat transmitted. The real heating surface, which determines the amount of heat transmitted, is the surface exposed to the fire.

In the preceding discussion it has been supposed that the heating surfaces were clean on both sides. As a matter of fact, heating surface is almost invariably more or less coated with soot or ash on the fire side and with scale on the water side. If the preceding discussion has been carefully followed, it will be clear that the transfer of heat will be much more interfered with by the deposits on the fire side than by deposits on the water side. To use again the analogy of the water pipes, a half-closed valve in the 1-in. pipe would have far more effect than a half-closed valve in the 12-in. pipe. It is no part of our purpose to excuse lack of care in keeping boilers free from scale; but it is nevertheless quite certain that a thin scale on boiler tubes does not interfere in any noticeable degree with the capacity or economy of a boiler, while the coating of the fire side of the tubes with a flocculent deposit of soot does certainly interfere in a marked degree with a boiler's steam-making capacity. Of course a thick scale on the water side of tubes or other heating surface, or any other material which acts as a non-conductor, may considerably obstruct the flow of heat. If it does this, the temperature of the heating surface itself will at once be raised, and may reach a point, as happens sometimes with the shells of externally fired boilers and with the furnaces of marine boilers, where the metal may be so heated as to bulge or buckle.

It may be worth while in this connection to administer a puncture to a certain hoary fraud which has been repeated in technical literature and trade catalogues "ad nauseam." We refer to a table purporting to give the loss of economy in per cents. for each 1-16 in. of scale upon the heating surface of a boiler. In view of the fact that there are many varieties of boiler scale, varying widely in porosity and heat conductivity, and remembering that the thickness of scale in different parts of a boiler is never uniform, it hardly needs the discussion above to show the utter absurdity of this ancient "fake."

Another deduction of practical importance from the fact just set down is that so far as the transmission of heat after the boiler is making steam is concerned, the circulation of the water in boilers is of a good deal less consequence than has been sometimes claimed. We do not mean by this that it is not worth while to make proper provision for circulation. There are possibly some parts of boilers worked with forced draft, such as the tube-plates of marine boilers, where it is so difficult for the steam bubbles to get away fast enough that we have a mass of foam instead of water in contact with the plate. Under such conditions, of course, the plate is bound to be heated; but this is probably a very rare occurrence, even in boilers which are pushed most severely. If anyone is inclined to stick to the old hobby that circulation is of great importance to economy, he would do well to consider the conditions in the narrow water space (about 3½ ins. wide), around a locomotive fire box, where the steam rushing up is directly opposed by the water going down. Let it be understood that we are referring to circulation only as affecting the transfer of heat and the consequent economy and capacity of the boiler. Good circulation is desirable to prevent unequal heating of the boiler, and consequent straining, and it may be of service in preventing deposits of scale and mud in places where they are least desirable; but that it has any appreciable effect on economy and capacity is not proved, and probably cannot be.

It has been demonstrated above that the surface exposed to the fire is the real heating surface of a steam boiler. Is there any good reason why this should not be generally adopted by engineers as the correct, and the only correct, method of computing heating surface?

The following are some reasons, good or bad, which are likely to be urged against this:

1. The makers of fire-tube boilers will claim that this gives the water-tube boiler makers an advantage. With the same number of tubes in a boiler, of the same length, the water-tube boilers can show 7 to 11 per cent. greater heating surface. This is of course true; but is it not an advantage to which the water-tube boilers are fairly entitled? It must be remembered that nowhere in this discussion has it been claimed that there was any fixed heat transmitting value for heating surface. On the contrary, it is entirely certain that a square foot of heating surface in one type of boiler may have double the heat transmitting power of an equal area in another. Again, the relative facility with which heating surface can be cleaned of soot and ash counts for a vast deal, more than most steam users are accumtomed to think. It certainly seems that the makers of fire-tube boilers have enough valid arguments to offer for their product without demanding the privilege of overstating their heating surface by 7 to 11 per cent.

2. Another argument offered for the use of the exterior surface as the heating surface is that this makes a given boiler show a larger heating surface than if the interior were taken. However much or little the argument may appeal to boiler manufacturers, it deserves no weight with engineers. A foot rule is no longer for calling it 13 inches.

3. It is urged that practice is and has in the past been fairly uniform in accepting exterior area as the heating surface, and it is best to stick to a uniform practice, even if it be in error, than to change. If the practice were actually uniform, there might be reason in this argument; but while the majority of engineers probably use the exterior surface of tubes in computing heating surface, there is a very respectable minority which insists on the correct method of computation, and this minority shows no signs of decreasing.

4. As the outside diameter of the tube is even inches, and the thickness of tubes varies, it is easier to compute the exterior heating surface than the interior. Probably this is one of the principal reasons why the outside surface has so frequently been taken; but in these days of tables and pocket-books and aids to computations, so trifling a matter as computing the interior area of a tube ought not to be an excuse for perpetuating an error. As a matter of fact, it will generally be less labor to do this than it is to figure the cost of the tubes with the numerous series of discounts which are frequently found on hardware bills in these days.

We believe that none of the arguments which have been cited in favor of computing the exterior surface of tubes as their heating surface justify engineers in perpetuating this error. If, however, for the sake of uniformity or ease of calculation, any one prefers to use the exterior surface of the tubes in fire tube boilers in computing heating surface, the fact that this is not the real heating surface ought to be kept clearly in mind. Misconception and wrong ideas on this point have been responsible for not a few mistakes and absurdities in the design of steam boilers.

LETTERS TO THE EDITOR.

"De Pontibus" from the Standpoint of the Consulting Engineer.

Sir: As in this work Prof. Waddell has given the profession a book which all will concede to be at least original, a few remarks concerning its contents from the standpoint of the consulting engineer may prove of interest in connection with the review published in Engineering News of March 31, 1898. It may be noted first that the author departs radically from the beaten path of bridge literature and plunges into a comparatively unexplored territory; he omits all theory of stresses and devotes his labor to laying down and elucidating practical principles of design; to investigations regarding economy in determining lengths of spans; and to the development of very complete sets of specifications governing materials, workmanship, general design, shipment and erection of railway and highway bridges and viaducts.

The introduction contains some very pertinent remarks on the advantages of having an engineer design bridge structures, instead of putting this work in the hands of the contractor. It is really surprising how many people, including even engineers and managers of railways, believe they are saving money by not engaging an engineer. They do not seem to realize that the designing of their bridges must be paid for by themselves in the end and that they might better pay a bridge engineer directly to design their structures in the interests of the railway company, rather than pay the contractor indirectly to design the structures in his own interest.

The principles of designing laid down by the author are many of them axiomatic, but the explanations given will prove of great value to the young designer. The subject of aesthetics is also well handled. This subject has not yet received the attention it deserves at the hands of our American bridge engineers and the author is to be commended for bringing it forward and giving it the importance to which it is so thoroughly entitled.

The chapter on cantilever bridges is made up almost entirely of matter not found elsewhere. In this chapter the author draws largely on his own practical experience for examples and gives many practical and valuable suggestions. He criticises several important structures, giving his reasons for each criticism. He also gives the results of an extremely valuable investigation by his assistant, Mr. Hedrick, of the most economic ratios for length of suspended span, to total length of the structure; also of most economic length of anchor arms, and of the relations between the weights of metal in suspended span, cantilever and anchor arms, anchorages and anchor spans. Diagrams for weights of cantilever and anchor arms are given, the data for the curves being obtained from actual estimates.

The chapter on inspection should prove interesting, not only to inspectors themselves, but to engineers who are necessarily dependent upon them to see that the specifications which have been prepared with so much care are lived up to by the contractor. A good many of our railroad engineers and consulting engineers place an inspector in the same position as a contractor, requiring him to give prices in competition with others and then place the work with the lowest bidder. This principle is hardly conducive to the best results, as the temptation must be to give the work as little attention as possible, either by curtailing the time given to the job or by placing cheap men in charge. Some engineers do not seem to consider that it makes any difference whether an inspector is paid $2 a day or $6, or whether he gives any attention to his work or not, as long as periodical reports come in. A good deal of work is let at prices per ton which the engineer himself could figure would not permit the inspector to give the work the attention he expects.

In short, the book as a whole is meritorious and reflects credit upon the author. It leaves little to be desired and covers a territory entirely its own.

Frank C. Osborn, M. Am. Soc. C. E.

Cleveland, O., May 27, 1898.

A Simple Rule for Determining the Maximum Bending Moment from Concentrated Loads.

Sir: In figuring bending moments for a series of concentrated loads it is often the case that there are two different positions of the loads that fulfil the requirements for giving

the maximum bending moment on the span, and it is necessary to work out both cases to find out the actual maximum. To illustrate: The stringers of a highway bridge are to be proportioned for a concentrated load of W pounds on each of two axles spaced a feet apart. With one load on the span the maximum moment is

$$M_1 = \frac{W x}{4}, \text{ where } x = \text{span}.$$

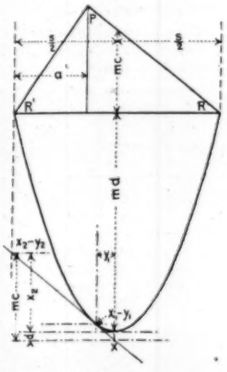
With both loads on the span the maximum moment is

$$M_2 = \frac{2W}{x}\left[\frac{x}{2} - \frac{a}{4}\right]^2.$$

In order to determine which equation gives the greatest bending moment, let $M_1 = M_2$. Then $x = 1.71a$, the span at which the two equations give the same moment. When

$$x \lesseqgtr 1.71a. \quad M_1 \gtreqless M_2$$

or for spans less than 1.71a one load at center of span will give the greatest bending moment, and for spans greater



than 1.71a two loads on span give the maximum moment. The same method is used where there are more than two loads, as in the case of the drivers of a locomotive.

Let x = span. For the case shown by the diagram the moments will be for

One load on span $M_1 = \frac{W x}{4}$.

Two loads on span $M_2 = \frac{2W}{x}\left[\frac{x}{2} - \frac{a}{4}\right]^2$.

Three loads on span $M_3 = \frac{3 W x}{4} - Wa$.

Four loads on span $M_4 = \frac{4W}{x}\left[\frac{x}{2} - \frac{a}{4}\right]^2 - Wa$.

$$\text{Let} \begin{cases} M_1 = M_2 \\ M_2 = M_3 \\ M_3 = M_4 \end{cases} \text{ then } \begin{cases} x = 1.71a. \\ x = 2.22a. \\ x = 3.73a. \end{cases}$$

Hence the following rule: For a series of equal concentrated loads equally spaced one load on the span gives the maximum moment where x is less than 1.71a, two loads on the span give the maximum moment when x is greater than 1.71a and less than 2.22a; three loads on the span give the maximum moment when x is greater than 2.22a and less than 3.73a, and four loads on the span give the maximum moment when x is greater than 3.73a; x being the span and a the distance between loads.

Respectfully,

Benj. W. Guppy,
Asst. Bridge Engr., Boston & Maine R. R.

Boston, Mass., May 19, 1898.

THE BOILER PLANT OF ARBUCKLE BROTHERS' SUGAR REFINERY, BROOKLYN, N. Y.

(With two-page plate.)

The new sugar refinery of Arbuckle Brothers, located on the East River near the Brooklyn end of the New York and Brooklyn bridge, is equipped with the most modern machinery in every department. The boiler house, which we illustrate on our inset sheet, is especially noteworthy for its numerous devices for the saving of space, of labor and of fuel. The building, which is four stories high, is entirely fireproof. The basement floor is to be occupied as a storage warehouse; the steam boilers and economizers are located on the two floors above, and the top floor is taken up by a great bin for the storage of coal. The chimney is located in the center of the building between the two economizers, as shown in the ground plan. The whole arrangement appears to be an admirable one for saving ground space, while at the same time it gives plenty of room for access to all the boilers and economizers, minimizes the length of horizontal flues, and provides for the easy equalization of the draft among the several batteries of boilers. The latter is a point that is often overlooked in designing boiler houses. The boilers are of the inclined water-tube type, of the vertical header pattern, made by the Babcock & Wilcox Co., 29 Cortlandt St., New York city. There are 23 boilers in all, each rated at 302 HP., or a total of 6,948 HP., 14 boilers being on the second floor and 9 on the third. They are set in ten batteries of two boilers each and three single boilers, as shown in the ground plan, which is that of the second floor. Each boiler contains 16 sections of tubes, each section being 9 tubes high. The tubes are 4 ins. diameter and 18 ft. long. Each boiler has two 42-in. drums. There are four economizers on each floor, one for each two batteries of boilers. The flues are so arranged that the gases from a pair of batteries may be carried either through its economizer or below it in case the economizer should require cleaning or repairs.

Coal is fed into the boilers by automatic stokers made by the American Stoker Co., of Brooklyn, N. Y. This stoker has been on the market but a few years, and was until recently made in Dayton, O., and used chiefly with the very smoky coals of the West. It is now being extensively introduced in the East for semi-bituminous coal. The stoker is of the underfeed type, and two stokers are placed under each 270 HP. boiler. It consists of a retort or magazine in the furnace and extending below the grate surface, and connected with a hopper located in front of the boiler by means of a conveyor pipe. In the bottom of this retort a worm is revolved by means of a small self-contained steam motor, which requires only about 0.2 HP. to operate it. The coal which is fed into the hopper is carried by the worm through the conveyor and the retort, up to and spread over the grate surface. Each one of these stokers is entirely independent of the other. The necessary air for the combustion of the fuel is furnished at a pressure of about 1½ oz. by means of blowers, which are hung in this case from the bottom of the coal bins. The air is admitted to the stoker through tuyere blocks placed on top and around the outer edge of the retort. The rate of feed of the coal and the amount of air used in the furnace are entirely under the control of the firemen.

With the use of these stokers it is found that the plant can be operated with fewer boilers and less labor than under any other operating conditions, owing to the fact that the boilers can be forced far beyond their rated capacity without any stoking of the fire by hand.

With the use of these stokers any grade and quality of coal, either anthracite or bituminous, can be burned without smoke at the stack. The plant may thus be operated with the cheapest fuel on the market, changing from one fuel to another if changes in price make it advisable. The forced blast enables the full capacity of the plant to be maintained with any fuel, and also enables the plant to be operated with a stack of considerable less height than is required for hand firing.

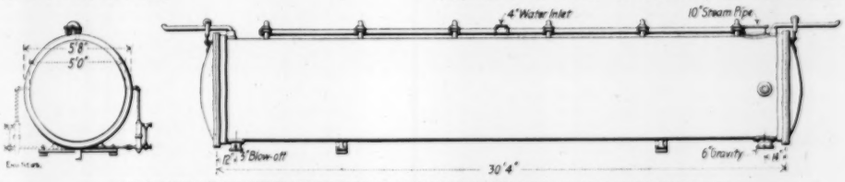
The coal is fed directly into the hoppers of these stokers from the large coal bin above by sheet iron coal chutes.

The boiler house being located close to the river, coal is received by boat and elevated therefrom directly into the storage bins. The coal handling machinery is furnished by the C. W. Hunt Co., 45 Broadway, New York city. The small cut, Fig. 6, shows the general arrangement of the machinery in relation to the building, and Fig. 7 shows the machinery in greater detail. A tower is built close to the wharf, and from it there extends over the water a parabolic trussed beam which is hinged at the tower so that it can be out of the way of the mast of a vessel. This beam forms the support for a traveling carrier, from which is suspended a clam-shell coal shovel operated by a hoisting engine located in the tower. The coal on being hoisted from the boat is deposited in a hopper in the tower, in which it is weighed by a scale overhead from which the hopper is suspended. From the hopper it passes into a coal-cracking machine, which reduces it to a size suitable for the stokers, and from the cracker it passes through a chute into a filler, which loads it into the buckets of the Hunt traveling conveyor. The endless chain of buckets then carries the coal up an inclined plane to the storage bin at the top of the boiler house, depositing it at any point in the length of the bin where it is desired.

The Geo. M. Newhall Engineering Co., Limited, 136 South 4th St., Philadelphia, were the architects of the plant.

SOME LARGE FEED WATER HEATERS AND PURIFIERS.

The Hoppes Mfg. Co., of Springfield, O., is building for the new refinery of the New York Sugar Refinery Co. three exhaust steam feed water heaters and three live steam feed water purifiers. The latter, we are informed, are the largest that have ever been built. The general construction of the Hoppes purifiers and heaters are well known. They consist of horizontal cylindrical shells, filled with a stack of pans with curved bottoms. The feed water drips from one pan to another, depositing its scale forming material, which is precipitated by the heat, upon the surfaces of the pans, largely on the under surfaces, as stalactites are formed. The pans are removed from time to time, through the end of the heater, for cleaning. The exhaust steam heaters furnished to the New York Sugar Refinery Co. are each 12 ft. 6 ins. long and 5 ft. 8 ins. diameter, with 16-in. exhaust steam inlets and outlets, 5-in. feed water inlet and 6-in. outlet, and are rated each at 1,500 HP. The purifiers, which are illustrated in the accompanying cut, are 5 ft. 8 ins. diameter and 30 ft. 4 ins. long, and are rated at 1,250 HP. As shown in the cut, the feed water is entered at six different



LIVE STEAM WATER PURIFIER FOR THE NEW YORK SUGAR REFINING CO.,
Built by the Hoppes Mfg. Co., Springfield, O.

points on the top of the heater, and is taken out through a 6-in. opening in the bottom. The steam is supplied through a 10-in. pipe. Both ends of the heater are movable, so that the pans may be removed from either end as may be most convenient.

CALCULATING THE TUBE HEATING SURFACE OF LOCOMOTIVE BOILERS.

In our editorial columns of this issue the question is discussed as to whether in computing the heating surface of a boiler the area exposed to the fire or that exposed to the water should be taken as the heating surface, and the reasons are given why the correct method is to take the area exposed to the fire. Some time ago it became necessary to revise our standard list of locomotive dimensions which we use for obtaining and publishing descriptions of locomotives, and the question arose as to the general practice of superintendents of motive power and locomotive builders in the computation of tube heating surface. We, therefore, sent out a number of inquiries to the principal railway companies and locomotive builders, and received some very interesting responses. Most of these replies are to the effect that the interior surface is the correct area to compute as heating surface in a locomotive boiler; but the outside surface has been more generally used, and many think it advisable to follow the more common practice. Others, however, take what seems

to us the very sound position that if it is worth while to compute heating surface at all, it is worth while to compute the actual heating surface, and not some other quantity.

We give below an abstract of a number of the replies received, which we think will be found of much interest:

Atchison, Topeka & Santa Fe Ry. (John Player, Supt. of Machinery).—It does appear to me that the tube heating surface should invariably be given as the interior area of the tube, for the reason that the exterior area gives out the heat absorbed by the interior area.

Baltimore & Ohio R. R. (Harvey Middleton, Gen. Supt. of Motive Power).—There is no question but that the interior of the tubes is the proper heating surface, but as it is the general practice to give the exterior, and this would give a proper idea for comparison between the different builders, it would probably be better to leave it as it is now.

Chicago & Northwestern Ry. (W. H. Marshall, Asst. Supt. Motive Power & Machinery).—I think it is better to use the outside diameter of the tubes in calculating the tube heating surface; not that this is a more correct method, but simply because heating surfaces are comparative, and it is much easier to figure the heating surface from this outside diameter (which is always in even inches or convenient fractions thereof) than to take the inside diameter. One advantage in figuring the tube heating surface by the external diameter is that it will be comparable with much that has been published in the past, for I think this has been the universal practice, except where it has been distinctly stated otherwise.

Chicago, Burlington & Quincy Ry. (G.W. Rhodes, Supt. of Motive Power).—There will probably always be a controversy as to whether tube heating surface should be measured on the inside or outside. The U. S. Government and the English Admiralty, the principal locomotive builders in this country, and some of the railways, have adopted the measurement based on the outside dimension, and as that is the size which is usually given in even figures for the dimension it would appear to be a well-established custom which ought to be maintained.

Erie R. R. (A. E. Mitchell, Supt. of Motive Power, and G. H. Goodell, Mechanical Engineer).—Although it seems to be more general practice to report tube heating surface as calculated from the outside dimensions, it is my opinion that all of the sound arguments are on the other side.

Michigan Central R. R. (Robert Miller, Supt. of Motive Power and Equipment).—It would seem as though the inside should be taken, as that is the part exposed to the fire, yet the practice has been to figure the part exposed to the water.

Northern Pacific Ry. (E. M. Herr, Supt. of Motive Power).—In regard to figuring the heating surface from the interior area of the tubes, there is no doubt that this is more rational, but I believe it is seldom done on account of the much greater difficulty in getting it accurate. The outside diameter of the tube is always known quite accurately, while the inside varies with the thickness of the tube used.

Pennsylvania Lines, West of Pittsburg (S. P. Bush, Supt. of Motive Power).—We agree with you in regard to the tube heating surface, that this should invariably be given as the interior area of the tubes, since the exterior area has simply to give out the heat absorbed by the interior area.

Baldwin Locomotive Works.—It does not appear to us that the tube heating surface should be calculated from the interior area of the tube for two reasons: 1. The area of water in contact with heating surface is the area of the exterior of the tube; and (2) as the nominal diameter of the tube is the exterior diameter, the interior diameter varies with each difference of thickness and considerable additional complication would result from endeavoring to calculate the interior diameter.

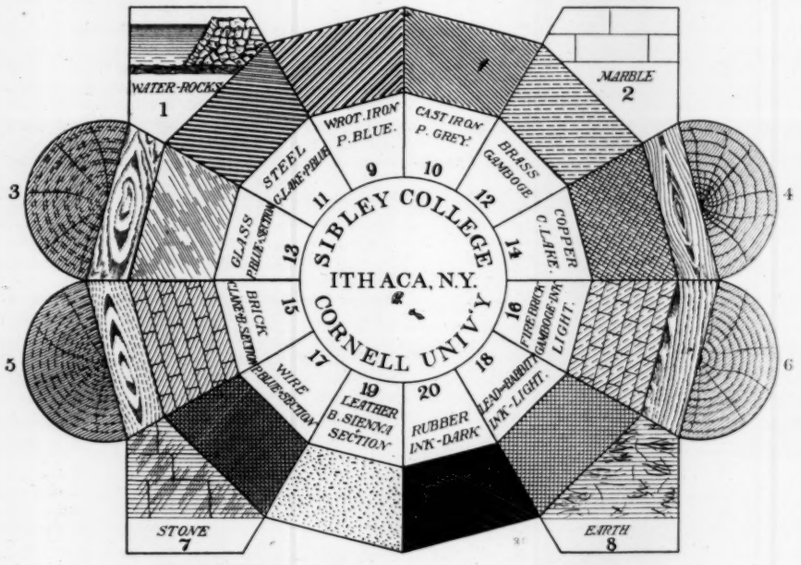
Brooks Locomotive Works (R. J. Gross, Vice-President).—We agree with you that the interior area of tubes should be given as the tube heating surface, as is the usual custom in giving the firebox heating surface. This, however, is not done by the builders, as a rule, so far as we are able to learn, for the reason that the total heating surface is desired to be as large as possible.

H. K. Porter & Co.—We have always been accustomed to figure the exterior tube area. It seems to us that the most important thing in this connection would be a general understanding, so as to always figure this matter in the same way.

Richmond Locomotive & Machine Works (G. F. Jones, Secy.).—We agree with you in regard to the heating surface, and always consider the interior area as the proper tube heating surface, as that is the part that is exposed to the heat.

Rogers Locomotive Co. (R. Wells, Supt.).—Theoretically the inside surface would be the correct basis for calculating heating surface, but owing to the variation in diameters due to the thickness of the tube it would not be practicable, or advisable, at least, to adopt it. The outside diameter is used in nearly all cases in giving tube dimensions; this is practically an even figure, and is much easier on that account to use as a basis for calculating. There is nothing in the matter of tube surface that requires any very minute figuring, as no one is very positive that any one definite ratio of surface is nearer exactly what it ought to be than one about that ratio. It does not matter much, I think, whether in a particular case, say 203 tubes are put in a boiler or 207, or 205 for that matter. The proper thing to do is to put in all you can without injuriously cramping the water spaces or interfering with a free circulation. As tube heating surface is usually about ten times that of the firebox heating surface, it seems scarcely worth while to get down so close in figuring as between the outside and inside surfaces from which to determine the proper proportion, especially when the ratio based on either surface can at best be only a fairly good guess as to what it ought to be to produce the best results practicable, and it is therefore as easy to guess correctly from the outside as the inside surface in getting at the matter of exactly what the tube heating surface ought to be. As the common practice is to figure on outside surface, it would not under the circumstances be worth while to change it. If outside surface is given it conveys the idea of just what the fact is, as well as if the inside surface was given.

Schenectady Locomotive Works (R. J. Pitkin, Vice-Pres. and Gen. Mgr.).—While the interior area in the tube is the one subjected to the heat, and consequently the accurate heating surface, the prevailing practice of locomotive builders is to use the external diameter of the tubes, and we believe it would lead to great confusion at this late date to change this practice.



CONVENTIONAL SECTIONS FOR MECHANICAL DRAWING.

At the 1895 meeting of the American Railway Master Mechanics' Association, a paper was read by Mr. F. W. Dean, M. Am. Soc. M. E., recommending in strong terms that the Association adopt the practice of computing the inside area of tubes as their heating surface as the best and only correct practice. In that paper Mr. Dean stated that the Rhode Island Locomotive Works uses the inside area as its standard, and also states that, while the U. S. Navy uses the exterior surface, they adopted this merely for the sake of ready comparison with the English Admiralty practice, and against their own better judgment.

A SYSTEM OF CONVENTIONAL SECTIONS.

The illustration presented herewith represents a set of drafting conventions prepared originally for use in the Sibley College of Mechanical Engineering, of Cornell University. Fig. 1 represents a section of rock, wall and water. When used without color, as in tracings for blue printing, the rocks are simply shaded with India ink, using preferably a 175 Gillott pen. For color drawing the ground-work is made of gamboge, or burnt umber, and the water is shown by a blended wash of Prussian blue. The convention for marble is shown in Fig. 2. To color this the whole section is made thoroughly wet, and each stone streaked with Payne's grey. Building stone in general may be shown as in Fig. 7, or colored with a light wash of Payne's grey, the shading lines being added with ruling and writing pens. For earth, India ink and neutral tint with India ink irregular-penned lines are used.

Chestnut is represented as in Fig. 3, to color which a ground wash of gamboge with a little crimson lake and burnt umber is used. The colors for graining should be mixed in a separate dish, and are burnt umber, Payne's grey and crimson lake in equal but sufficient quantity to make a contrast with the ground color. Fig. 5 represents black walnut; the coloring, when desired, consists of a ground of Payne's grey, burnt umber and crimson lake in equal quantities, using the same mixture, with the addition of more burnt umber for the graining. Hard pine, drawn as in Fig. 6, is colored with a light wash of crimson lake, burnt umber and gamboge in equal parts, with a graining mixture of crimson lake and burnt umber.

Woods in general are shown in Fig. 4, which should be colored with a light wash of burnt sienna and grained with a writing pen, and a dark mixture of burnt sienna and India ink.

The other sections are solid wash colors and need no explanation beyond that given in the cut.

It is not intended that these sections, and more particularly the coloring, should be used for rough or hurried drawings. In preliminary work for estimates, and in many other cases, well-finished and artistic drawings are necessary, and in such instances the conventions given will be useful. The designs were prepared by Mr. John S. Reid, of Sibley College, Cornell University.

THE RELATIONS BETWEEN THE PURCHASER, THE ENGINEER AND THE MANUFACTURER.*

By William H. Bryan, M. Am. Soc. M. E.†
(Member of the Society.)

In the erection of buildings, the precedent of placing the work in the hands of a skilled architect has long since become well established. In civil engineering, the construction of railways, bridges, and roofs, is universally intrusted to engineers. In the newer branches of mechanical and electrical engineering, however, it has only recently become the practice in this country to engage consulting engineers. The principal reason for this has been that there have been heretofore but few specialists who have devoted their attention exclusively to this class of work. The few well-trained men in these fields early connected themselves with manufacturing or contracting companies, or entered into these branches of work on their own responsibility.

This situation has, however, in a large degree changed, owing to the large number of excellent engineering schools and the very thorough courses of theoretical and practical training which are there given. These, coupled with the large number of trained and experienced men who have been connected with prominent manufacturing and constructing companies, and with the installation and operation of large plants, have now rendered available the services of many men of thorough technical training, supplemented by years of practical experience in actual construction. Many of these have no connection with the

*Condensed from a paper presented at the Niagara Falls meeting of the American Society of Mechanical Engineers.
†Turner Building, St. Louis, Mo.

manufacturing, selling and contracting interests, and their judgment is not, therefore, open to the suspicion of bias in favor of or against any special manufacturer.

It is becoming more and more the custom, therefore, to place the same confidence in the consulting mechanical and electrical engineer which has long been reposed in the architect and civil engineer. He is called in at the earliest stages of the development of the enterprise, for advice as to the general outline and arrangement of the scheme, its probable cost, the expense of operation and maintenance, and the returns which may be expected from the investment. He makes a preliminary reconnaissance and report giving this data. If these are approved, he then makes a more detailed study of the problem, mapping out the general scheme more definitely, selecting the particular system or type of apparatus best suited to the local conditions of service, and preparing general plans and specifications. These he accompanies with more detailed estimates of cost. When these are approved by his principals, proposals are asked for, and when received, the engineer assists the purchaser in canvassing and comparing them, and in selecting that proposal—not necessarily the lowest—which seems best to meet the requirements of the work in hand.

The engineer then assists his clients in drawing up the final contracts, supervises the work during construction, and makes such final inspections and tests at completion as are necessary to determine whether the specifications have been complied with.

This has long been the accepted custom in England, where the same difficulty of securing competent and unbiased engineers has not been encountered. No trouble has been met with in that country in applying the same rules to these branches of engineering which are universally followed in other fields.

As might be expected in any new department of engineering, however, the relations between the purchaser, the engineer and contractor have not always been harmonious. The present misunderstandings may be traced to a few serious causes: In the first place, the mechanical and electrical fields of work have, unfortunately, been embarrassed by too great a number of incompetent and inexperienced manufacturers and contractors, poorly equipped for good work, and with but limited intelligence and skill. To these have been added a more than ordinarily large percentage of contractors, who are not altogether scrupulous as to their methods, and whose object is to finish the work in almost any sort of shape which will pass muster. These incompetent, inexperienced and unscrupulous contractors—though relatively few in number—have detracted from the good reputation of work of this character, and have forced upon the consulting engineer the necessity of inserting in his specifications the most rigid requirements as to the character of workmanship and material, inspections and tests, which would be unnecessary if it were certain that the work would be awarded to contractors of established reputation, ability and skill.

Furthermore, it has been found that some manufacturers are slow to adapt their designs and patterns to advanced and improved practice. Experience having shown the clear and decided superiority of certain designs, the engineer is justified in embodying them in his specifications, in spite of the fact that some manufacturers will attempt to force the continued use of antiquated forms.

Again, the manufacturers are often careless in making guarantees. Some of them do not hesitate to meet any desired figures, if a competitor does so. Often they will oblige themselves to do what is impossible with the type of machinery they offer, and trust to luck, or careless inspection or testing, to get the work accepted and paid for.

The grievances of the manufacturers have recently taken shape in papers and discussions in the electrical press, and may be briefly summarized as follows:

1. That the engineer appears unwilling to receive suggestions or advice from the manufactureres, as such action might detract from the "dignity" of his position, and that specifications, therefore, often contain many annoying and expensive provisions, sometimes impossible of fulfillment.
2. That the engineer does not always familiarize himself with the facilities and standards of the manufacturer, and thus sometimes calls for special designs which can only be made, if at all, at greatly increased expense; whereas standard apparatus would frequently answer the purpose equally well.
3. That if the manufacturer is required to guarantee results, he should not be hampered as to details of design or construction. In other words, the consulting engineer should not tell the manufacturer how he should build his machine, but simply hold him responsible for results.

To the first of these it may be answered that no harm can be done by full and free consultations between the manufacturer and the engineer. They have a common object in view, namely, the securing of the best results. It is natural that the engineer should reserve unto himself a due degree of dignity, but he should not let this characteristic stand in the way of the best service in the interest of his clients.

The demand for special machinery, however, presents greater difficulties. It should be remembered that electrical developments have been so rapid in recent years—and with them the construction of special steam engines and appliances—that a large percentage of the work has necessarily been special. Furthermore, this condition must continue, for the reason that the methods of generating and distributing electricity on a large scale, over wide areas, for endless varieties of purposes, have by no means reached uniformity of practice or system, and are not likely to very soon. The necessity for special machinery will, therefore, remain with us indefinitely, and will continue to cover a large percentage of our work. We must not lose sight of the fact that to attempt to carry the idea of standards too far, will surely result in hindering improvements and stifling progress.

I do not desire to be understood, of course, as decrying the use of standard apparatus for that large and increasing percentage of cases for which it is eminently well adapted. The manufacturers deserve great credit for reducing their machines for different classes of service to standards, and the engineering profession is under many obligations to them for doing so, in so thorough and excellent a manner. The reduced cost of standard apparatus—the fact that in using it, one follows precedent—that repairs can be more quickly and more cheaply obtained, and that when secured the different parts are actually interchangeable, and will fit, and the further fact that standard machines can usually be secured in less time, being frequently carried in stock—all these are points of tangible advantage which no conscientious engineer can afford to overlook. Standard apparatus, however, is only possible when permanency of type and a reasonably constant demand in large quantities is assured. While it will frequently pay the engineer to modify his plans so as to use standard apparatus, there is a point beyond which he cannot go. In such cases he must use special apparatus more closely adapted to his particular needs. All these points must be given the most thorough consideration, and before requiring special work the engineer must satisfy himself, beyond doubt, that his principal's needs can better be supplied in this manner, even at the increased cost, and in spite of the greater risks which always acompany the use of new and untried apparatus.

The contention that when a manufacturer guarantees results he should be allowed to design and build the machine in his own way, may be granted in so far as the guarantee can be made to cover every possible valuable feature. When a reasonable number of manufacturers, however, have adopted certain designs and processes of unquestioned superiority, and where these have an important bearing on the life and reliability of the machine, its freedom from annoying interruptions, and which reduce or avoid the necessity for close and continual attention, is it proper to write the specifications so as to limit competition to machines of this advanced type?

Contractors frequently object to specifications which include a deduction for delay in completing the work, but which allow no extra compensation for finishing the work earlier than the date specified. When it is possible for the purchaser to make use of the plant at the earlier date, this criticism is well founded. It is usually the case, however, that the earlier completion in no way benefits the owner, because other equally important contracts may not be finished, or because the date of leases or contracts for service from the plant cannot be brought forward. The delay of any one contractor, however, might readily cause the purchaser serious loss.

Another objection made by the manufacturer—and one which is not wholly without justification—is the unnecessarily exacting requirements of some specifications, and the annoyance to which they are subjected by the engineers. It is unfortunately true that our profession has been no more fortunate than others in keeping out of its ranks the incompetent and the unscrupulous. These men have brought disgrace upon the profession, and the objection of the manufacturers to being handicapped by them is well founded. There is, however, no reason now why the purchaser—even though absolutely unfamiliar with work in this field—should make a mistake in selecting an engineer, as a very little investigation will enable him to ascertain the character, ability, and experience of the man under consideration.

The engineer stands between the purchaser and the contractor, and while he may sometimes insist upon his client's rights to an extent which may appear unjust, he nevertheless recognizes the purchaser's obligations as well, and will see that his end of the contract is equally well maintained. In this way unreasonable requirements may be avoided, prompt payments secured, and the acceptance and settlement made at the proper time, and along reasonable lines.

Early in my own practice I learned that while elaborate and detailed specifications embodying all sorts of unusual and peculiar requirements might impress the non-technical reader, and might even gratify the purchaser, they invariably limited competition, and led to excessive prices and annoying delays, and that by purchasing machines as nearly standard as possible, and by modifying the contract to a reasonable extent, to suit the manufacturer in unimportant details, much better terms could be made, without increased trouble to either the purchaser or the engineer.

The contract forms submitted by many manufacturing companies are unfair to the purchaser, in that they are wholly one-sided, and are intended to protect the seller in every way possible, while the rights of the purchaser are given but little consideration. Such contract forms are far too common, and for the credit of the profession, it is hoped that these may be modified and brought to a more equitable basis.

The ordinary proposals submitted by many companies are equally unfair. Perhaps the most flagrant instance of this is the statement in many bids that they are not effective until approved by an executive officer. Such proposals are not worth the paper they are written on, and should not be considered for a moment by any self-respecting engineer, as they in no way bind the bidders, and their acceptance simply ties up the purchaser. Instances are not lacking where manufacturers have taken advantage of this clause to repudiate bids apparently made in good faith. So common is this practice that it has become necessary to incorporate a clause in the "Notice to Bidders," to the effect that proposals which are not made in good faith will not be considered.

Another unfortunate practice is that which many manufacturers have of asking the return of their proposals and accompanying data as soon as the award is made. These papers are necessary to the purchaser and the engineer to make a complete record of the transaction, and should be retained by them.

On the other hand, it must be admitted that some engineers' specifications are unfair to the manufacturer. The points on which these complaints are based have been given due consideration, and in my own practice have led to the following rules:

1. When it is desired to permit the bidder some elasticity, and not to require him to adhere rigidly to the specifications, the "Notice to Bidders" contains a clause reserving the right to waive informalities.
2. The engineer is made the arbitrator of all disputes, but appeal is always permitted to a referee or referees. If the contractor thinks he is being treated unfairly he may avail himself of this privilege.
3. A clause is frequently inserted to the effect that where a special make or type of apparatus is mentioned in the specifications, it is not intended to mean the exclusion of all others, but simply as establishing a standard of excellence. The bidder may substitute other apparatus in his proposal, the engineer reserving the right to judge as to whether the article offered is equivalent to that specified.
4. Where the work is such that it is impossible to go into details very fully, and where the apparatus is of such a character that different builders offer different types of construction, which accomplish substantially the same results; or where it is desired to secure the benefit of the most recent improvements, a general clause like the following is sometimes inserted:

While it is believed that the following specifications properly cover the needs of the purchaser at this time, they are not necessarily final. Bidders are invited to submit alternative propositions embodying any other types of apparatus, or other details of construction, which in their judgment may seem as well, or better, adapted to the purchaser's needs.

LEGAL DECISIONS OF INTEREST TO ENGINEERS.

Contracts Restricting Competition.

Where parties combine to stifle competition in bidding on certain public works, and the contract is thereupon secured by one of them, a further agreement between them to share the profits and losses under it is tainted with illegality and not enforceable. Hoffman v. McNulen (U. S. Cir. Ct. App.), 83 Federal, Rep. 372.

Must Employ Competent Civil Engineer.

Where a contract for railroad construction provides that the engineer of the company shall act as umpire, and shall finally decide the amount and character of the work and material furnished, the company is bound to employ a thoroughly competent and honest engineer, and to see that he performs his duty honestly. Spalding v. Coeur D'Alene Ry. Co. (Idaho), 51 Pacific, Rep. 408.

Effect of Payments with Deductions.

A contractor who accepts payments with deductions from the contract price, no receipt beyond the amount received being given, is not by so doing deprived of his right to sue, unless the acceptance of a less sum is proven to have been by way of accord and satisfaction for the greater. Finley v. United States (U. S. Cir. Ct. Cl.), 32 Ct. Cl., Rep. 546.

Contractor Bound to Know Contents of His Agreement.

One who cannot read a contract which he is about to execute, is bound to procure it to be read and explained to him before he signs it, and is chargeable with knowledge of its contents whether he does so or not. Chic., St. P., M. & O. Ry Co. v. Belliwith (U. S. Cir. Ct. App.), 83 Federal, Rep. 437.

Property-Owners Have Right of Use of Street.

If at any time the owner or lessee of property abutting on a street has occasion for the presence of vehicles in front of his property on the street to take away or deliver persons or goods, he may exercise that right for such reasonable time as is necessary for his purposes, even though the passage of street cars is thus impeded. Peterson v. Pittston (Pa. Com. Pl. Ct.), 8 Kulps Rep. 530.

Street Cars Have Right of Way on Their Tracks.

While the traveling public and street cars have equal rights to the use of public streets, the cars, by necessity, have a right of way on their tracks; and although this does not give them a right to exclude the public, in case of conflict the individual traveler or vehicle must yield. Hot Springs St. Ry. Co. v. Johnson (Ark.), 42 S. W., Rep. 833.

Liability for Not Building Culverts.

For a railroad company to build a solid embankment for its track over a depression forming a natural channel, wherein surface water was accustomed to flow, when it was practicable to construct a culvert through the

embankment, is negligence and it is liable for resulting damage. Jungblum v. M. N. U. & S. W. R. Co. (Minn.), 72 N. W., Rep. 971.

Damage by Surface Water.

A city is not liable to a property-holder for damages to his property from surface-water diverted upon such property by reason of a change of grade of the streets, where there was no negligence in making such change of grade. Smith v. City of Goldsboro (N. C.), 28 S. E., Rep. 479.

No Recovery Unless Completed in Time.

Where a contract provides, in conformity to the ordinance, that the work shall be completed within a certain time, the contractor in effect agrees that, if he does not perform it in that time, there is no performance, and therefore a provision of the city charter authorizing a recovery on a quantum meruit has no application where there is a failure to complete within the time specified. McQuiddy v. Brannoch, 70 Mo. App. Ct., Rep. 536.

Liability of City Operating Lighting Plant.

A city is liable for negligence in the construction, repair and operation of its electric lighting plant, such work not being in the exercise of powers which are public and governmental, but of a proprietary character, and conferred for the private advantage of the city. Bullmaster v. St. Joseph, 70 Mo. App. Ct., Rep. 60.

Contracts Must be Paid Out of Each Year's Income.

Though the fund on which one relies for payment is exhausted after he furnishes materials to a city, and before he presents this bill, he must, nevertheless, under a constitutional limitation on the city, declaring that each year's revenue shall pay each year's indebtedness, look for satisfaction of his claim in that year's income in which the obligation was contracted. Montague v. English (Cal.), 51 Pacific, Rep. 327.

View in Tower, Park Row Syndicate Building, Showing Hollow Tile Fireproofing of Skew Panels in Floor.

A COMMON TYPE OF DEFECT IN HOLLOW TILE FLOOR ARCH CONSTRUCTION.

We supplement the examples of defective hollow tile floor construction, illustrated in our issue of April 14, 1898, with the accompanying view of a portion of one of the floors in the polygonal towers surmounting the Park Row Syndicate Building in New York, which is particularly interesting for the clear manner in which it shows how poorly hollow tile or fireproofing material of any kind in the shape of blocks or bricks is adapted for filling irregular spaces such as occur where a strictly rectangular arrangement of the beams is not possible. In the panels where straight work is possible the arches show all of the characteristic faults mentioned in our previous article, but as soon as the triangular corners are reached all these faults are emphasized until the construction becomes hardly more than a conglomeration of tiles and parts of tiles wedged together as well as possible with daubs of mortar to fill the interstices. The obvious faults in this particular example of floor construction, however, are chiefly important for the manner in which they show how the fireproofing under certain conditions becomes pure patchwork, without design or system, owing to the inflexibility of hollow tiles to any other arrangement than that for which they are especially designed. As every engineer who has studied the question knows, however, a perfectly rectangular arrangement of the floor beams throughout an entire building is not easy to secure in all cases. In many instances the irregular shape of the lot on which the building is erected is enough to introduce skew connections and irregular spans, and these may be still further distorted by the necessity of providing light shafts and elevator wells in cramped quarters. The disturbing effect which all this has upon the efficiency of hollow tile floor construction is clearly shown by the accompanying illustration and is worth careful study, principally because it is a feature of the question to which comparatively little attention has been given.

MODERN HIGH EXPLOSIVES.

At a late meeting of the Engineers' Club of Philadelphia, Mr. Louis Y. Schermerhorn presented a paper upon modern high explosives which is especially interesting in these times, and the following abstract is made of some of the more popular points included:

Low explosives are mechanical mixtures, such as black, brown and prismatic powders. High explosives are chemical compounds, and those in more common use are all variations of nitroglycerine and guncotton. The former is the result of the action of nitric and sulphuric acids on glycerine, and the latter results from the action of the same acids on cotton or other forms of cellulose. Explosive gellatine, ranking as the highest in explosive power among these latter compounds, is made by dissolving 10% of guncotton in 90% of nitroglycerine, with a small amount of camphor added to make it less sensitive. The fulminates, another class of high explosives, are unstable compounds which detonate under a jar, scratch or light electric spark. The less sensitive of these, such as mercuric fulminates, are generally used to detonate the nitroglycerine and guncotton compounds.

Dynamite, the commonest form of high explosives, is simply a mixture of nitroglycerine with an inert absorbent, such as sawdust, wood pulp or infusorial earth. So-called dynamite No. 1 contains 75% of nitroglycerine and 25% of absorbent. In this form a cartridge may be ignited by a match, when it will simply burn with a dense smoke without explosion. Dynamite freezes at a temperature of about 45° F., and it can then only be exploded in a loose form. One pound of dynamite shows an explosive energy exceeding by 25% the explosive energy of one pound of nitroglycerine, although in the former case it is the contained nitroglycerine alone that exerts force. This anomaly is explained on the theory that the porous character of the dynamite permits a more complete permeation of the mass by the disruptive force of the initial explosives, and thus produces a more complete detonation; in other words, in the case of the nitroglycerine conditions prevent our obtaining the full amount of the contained energy.

The relative energy of the several explosives has been assumed to be about as follows, with gunpowder as the unit: Gunpowder, 1; nitroglycerine, 4; dynamite, 5; guncotton, 5; explosive gelatine, 6. It has been calculated that one pound of nitroglycerine develops about 1,100 ft.-tons of potential energy, though all of such comparisons must be accepted as rough approximations. The rationale of the detonation of these explosives is not well understood; heat alone does not operate, as wet guncotton can be exploded. From the phenomenon of sympathetic explosions it is assumed that detonations is probably the result of vibratory action of the detonating agent upon the molecules of the explosive. If these molecules are retained in stability by delicately balanced forces the sharp initial explosion of a fulminate may throw these forces into changed vibrations, break up the molecules and cause explosions in the mass.

Experience shows that the energy of a high explosive depends somewhat upon the nature of the initial detonation. One ounce of gunpowder exploded in contact with guncotton only inflames the latter, while 10 grains of confined fulminate of mercury will produce a full explosion. But 45 grains of unconfined fulminate will again only inflame the guncotton. Even a large quantity of dynamite exploded in contact with guncotton only disperses it, while a small mass of dry guncotton detonated upon a mass of wet guncotton will make a perfect explosion. Guncotton is exceedingly inflammable, and when in store it is very generally kept wet.

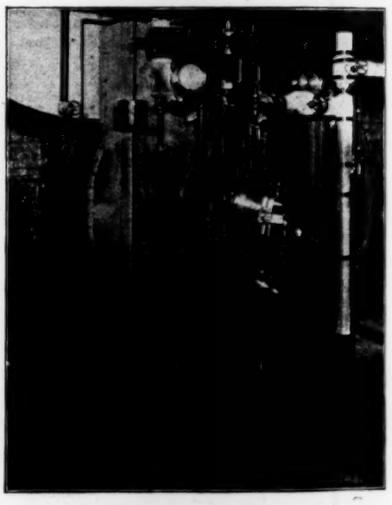
Sympathetic explosives were utilized in the removal of Flood Rock, in the East River. Here the 300,000 lbs. of high explosive were divided into 13,150 separate charges; but only 5% of these charges were electrically connected with the firing battery; the remainder were arranged to explode sympathetically.

According to experiments made by the English government some years ago, the action of submerged explosives upon the hulls of vessels was about as follows: At a horizontal distance of 50 ft. and a submergence of 40 ft., 500 lbs. of compressed guncotton was exploded without serious injury to an iron ship; but at a distance of 30 ft., with the same submergence, the iron hull was so crippled that the vessel sunk.

In speaking of earth waves induced by the explosion of dynamite, etc., the author said that the explosion of 200 lbs. of dynamite on Long Island could be detected five miles away with a velocity of transmission through the earth of about one mile per second. With 20,000 lbs. of dynamite, at eight miles away, the earth wave had a velocity of 8,300 ft. per second, and at 13½ miles, 5,300 ft. per second.

A FORCED DRAFT SYSTEM FOR LOW GRADES OF FUEL.

An interesting working example of the use of forced draft for burning five sizes of anthracite coal is shown at the Electrical Exhibition in Madison Square Garden, New York city. It is known as the Beckman system, and is being introduced by Francis Brothers, of the Kensington Engine Works, Ltd., Philadelphia. The accompanying half-tone is from a photograph taken at the exhibition. The fan blower supplies air under the grates of the Babcock & Wilcox boilers, which supply steam for the machinery of the exhibition, the air pressure being about ¾-in. of water, at maximum load. The speed of the fan and, consequently, the quantity of air supplied to the boilers, is automatically regulated by the steam pressure in the boiler, the fan slowing down as the pressure increases beyond the desired point. The Beckman system includes the blower and an engine to drive it, with a regulating valve placed on the steam inlet pipe to the blower engine, so arranged as to open and increase the speed of the fan when the pressure of steam in the boilers falls below the desired point, and to close this valve when the pressure is restored. There is also a pressure reducing valve placed in series with the regulating valve to limit the high speed of fan and the consequent draft pressure. A by-pass around the regulating valve admits a little steam to the engine when the regulating valve is closed, and gives the fan just enough speed to keep up the combustion and keep the grates cool.



A Forced Draft System with Automatic Regulation of Draft Pressure.

A REVERSIBLE GAS ENGINE.

An interesting and decidedly novel type of gas engine now being introduced is one designed specially for marine work, which can be reversed as easily as a steam engine. Marine engines must, of course, provide for reversing the screw, so as to drive the vessel or launch ahead or astern as required, but in general this is done by means of gearing. The engine then drives the shaft direct for going ahead, but for going astern a train of gearing is thrown into action. The Wolverine reversing engine, Fig. 1, has three inverted direct-acting cylinders, A, B, C, driving a crank shaft to which the propeller shaft is attached. The engine is balanced by having the three cranks set at angles of 120°, and a heavy flywheel ensures steadiness of running. On the crank shaft, close to the flywheel, is a spur wheel, D, gearing with an intermediate idler wheel, E, having a wide face. This in turn drives a spur wheel, F, on the shaft, J, and this spur wheel has on its inner face a sleeve, G, and a collar, H. The shaft, J, carries the eccentrics, K, K, K, which operate the exploders. On the end of the eccentric shaft is a spiral groove or keyway, L, and the gear wheel is secured to the shaft by a key which fits in this groove. Below the eccentric shaft is another shaft, M, sliding laterally in its bearings and having an arm, N, which rests against the sleeve, E, just mentioned, between the gear wheel, F, and its collar. This shaft is operated by a vertical reversing lever, O, pivoted to the middle cylinder casting. When the reversing shaft, M, is moved, it slides the gear wheel and sleeve along the eccentric shaft, the key in the spiral groove revolving this latter shaft so as to change the lead of the eccentrics.

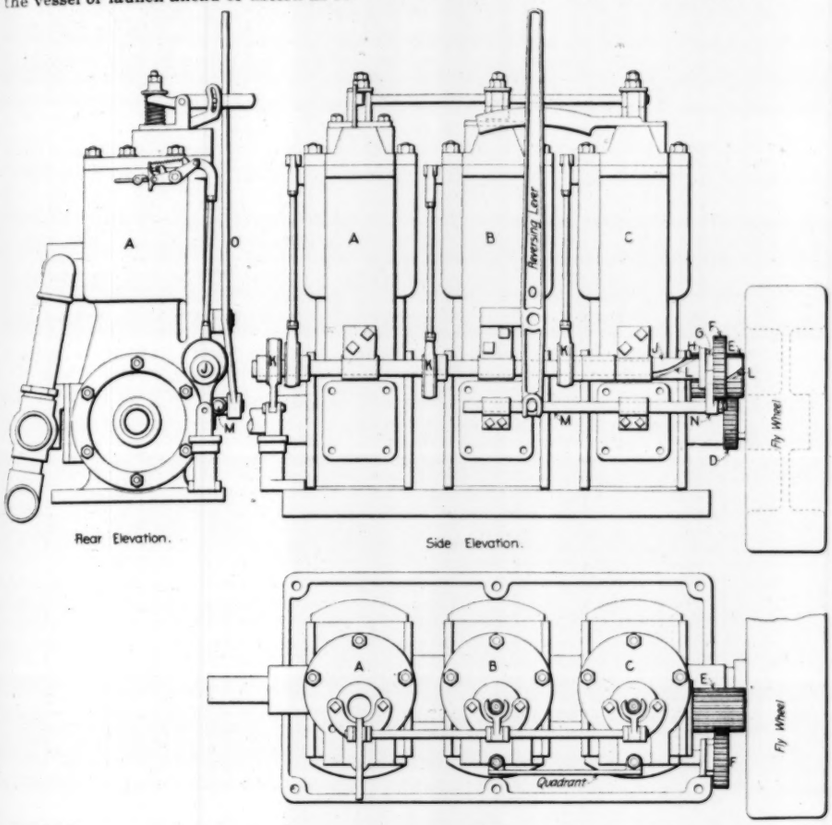


FIG. 1.—REVERSIBLE GAS ENGINE.
Wolverine Motor Works, Makers.

When the reversing lever, O, is in the corner of the quadrant towards the flywheel, the exploders are set for the engine to run forward, that is, with the top of the flywheel turning to the right. When the lever is set in the opposite corner of the quadrant, the exploders are set for the engine to run in the reverse direction. When the reversing lever is in either corner of the quadrant the exploders are set so that the spark is made just after the piston starts on its downward stroke. When the engine is started, the reverse lever is moved up towards the center of the quadrant, which makes the spark occur before the piston comes to the top of its up-stroke. The exploders can be set in any position when the engine is running, so as to get the best possible results. To reverse the engine while running, the battery switch is thrown out, and when the engine has slowed down, the reversing lever is thrown to the opposite corner of quadrant and the battery switch thrown on. The engine will then reverse and run in the opposite direction. When the engine is at rest it can be started in either direction by simply moving the reversing lever according to the direction in which the engine is wanted to run.

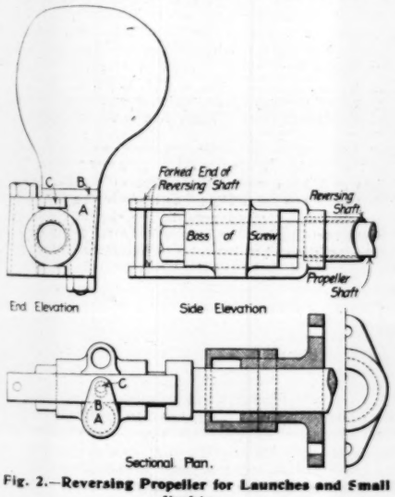
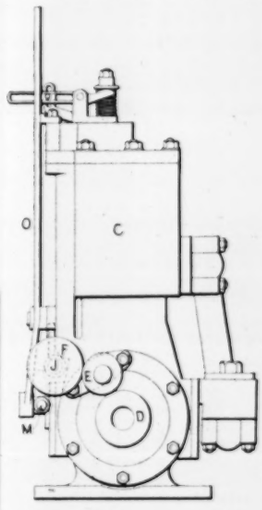


Fig. 2.—Reversing Propeller for Launches and Small Yachts.

These engines are made in various sizes, from 9 HP. to 45 HP., and a number of them are in use. For small launches, with gas engines up to 4 HP., a non-reversing engine is used with a reversible two-bladed propeller, shown in Fig. 2. Each blade has a conical stem, A, fitting a hole in the hub or boss and secured by a nut on the threaded end of the stem. In two grooves in the boss works the forked end of the reversing shaft, and at the base of each propeller blade is a horizontal lug, B, having on its under side a short pin, C, fitting into a hole in the fork. As the reversing shaft



(which is a pipe in which the propeller shaft is enclosed) is moved to and fro, by means of an ordinary lever arrangement, the propeller blades are turned to any desired position.

The engines and propellers are manufactured by the Wolverine Motor Works, of Grand Rapids, Mich., to whom we are indebted for drawings and other information.

BOOK REVIEWS.

GAS, GASOLINE AND OIL VAPOR ENGINES.—A New Book on the Subject Descriptive of Their Theory and Power; Illustrating Their Design, Construction and Operation. For Stationary, Marine and Vehicle Motive Power. By Gardner D. Hiscox, M. E. Second Edition, Revised and Enlarged. With 270 Illustrations. New York, Norman W. Henley & Co.; 8vo.; cloth; pp. 351; $2.50.

The first edition of this book was reviewed at considerable length in our issue of April 27, 1897. The present edition is no improvement on the first as far as the theoretical part is concerned, for nearly all the errors and defects in the first edition are uncorrected. As we said a year ago, the author frequently uses technical terms without defining them, and his discussion contains so many errors that it is practically worthless for either the ordinary reader or the technical student.

The descriptive part of the book is considerably enlarged in this edition, descriptions of about a dozen new engines being added. This part occupies nearly two-thirds of the whole book, and is practically a reprint of matter found in the circulars and catalogues of gas engine makers, with wood-cuts and half-tones of varying degrees of quality, most of them being poor.

REPORT OF THE TESTS OF METALS AND OTHER MATERIALS FOR INDUSTRIAL PURPOSES, Made with the United States Testing Machine at Watertown Arsenal, Mass., during the Fiscal Year ending June 30, 1896. Washington: Government Printing Office, 1897. Cloth, 8vo.; pp. 495.

This volume contains the usual annual report of the work of the Watertown Testing Machine with hundreds of long tables of figures and numerous diagrams, half-tone cuts and memoranda concerning details of the specimens tested. The materials tested include steel for rifled guns and other purposes, springs, cast-iron, chain cables, alloys, riveted joints, wire, manila and hemp ropes, etc. The book might be of some value to the public if a digest, covering 20 to 50 pages, had been made of it, including those figures which reveal some fact that is worthy of note, but in its present shape it is like looking for a needle in a haystack to attempt to find in the book the useful facts which no doubt it contains. In the letter of transmittal to the Chief of Ordnance, which prefaces the report, Maj. J. W. Reilly, commanding officer of the Watertown Arsenal, justly praises Mr. James E. Howard, who has had charge of the machine since it was first set up, now 20 years ago, for his accurate and faithful work. His labors are said to be invaluable to the government. We would suggest that it is high time that Mr. Howard be withdrawn from the drudgery of making tests and detailed records, and assigned for a year or two to the duty of digesting, compiling and condensing from the several yearly reports of the work of

the great machine, those facts which are of real importance to the engineering world. If the records of all the tests that have been made on the machine could be overhauled and the useful results published in a book, of say 500 pages, which should include, besides the bare records of tests, a proper comparison of them with the results predicted by formulas with other tests of similar materials, the resulting book would be vastly more valuable to the government and to the world at large than all the existing Watertown reports taken together.

MACHINISTS' AND ENGINEERS' POCKET MANUAL.—A Compilation of Rules and Solved Problems Pertaining to Steam Engines, Steam Boilers, Steam Pumps, etc., based on Plain Arithmetic, together with Necessary Tables and Data, Embracing a Dictionary of Terms Used in Steam Engineering and Electricity—the Construction and Operation of Dynamos and Motors—Artificial Refrigeration and Ice-Making—A Treatise on the Steam Engine Indicator—Gearing, Shafting, Lathe Screw Cutting, etc., etc. With original illustrations. Edition by D. B. Dixon. Chicago: Laird & Lee. Leather flap; 3 × 4½ ins.; pp. 381. $1.00.

This is a small book with a long title, and contains a great deal of matter for a dollar. The first 124 pages contain a dictionary of technical terms used in engineering, then follow 5 pages on "How to Connect Dynamos and Motors," 75 pages of mathematical tables, weights and measures, etc.; 12 pages on Refrigeration and Ice-Making, 14 pages of questions and answers for applicants for stationary engineer's licenses, 18 pages of promiscuous examples to be solved by arithmetical calculation, 18 pages concerning shafting, twist drills, wire resistances, etc.; 6 pages on gearing a lathe for screw cutting, an article by George B. Grant covering 50 pages on "Theory and Practice of the Teeth of Gears." Tables of circles, 15 pages; Indicator Practice, 33 pages, by James F. Hobart. That is all, and it is as much as one should expect in a pocket manual that sells for a dollar.

STEEL IN CONSTRUCTION.—Convenient Rules, Formulas and Tables for the Strength of Steel Shapes Used as Beams, Struts, Shafts, etc., made by the Pencoyd Iron Works. A. & P. Roberts Co., Philadelphia, Pa. Leather; 4½×6½ ins.; pp. 346; 35 full-page plates and other illustrations. $2.

We are fully justified, we think, in saying that this volume is one of the handsomest examples of its particular class of trade publications which has ever come to our notice. In binding, which is russet leather, with neatly stamped gilt titles and full gilt edges, as well as in printing typography and illustrations, the book is excellent in all respects. To those who are familiar with the previous editions of the "Pencoyd Pocket Book" about all that needs to be said in explaining its scope is that the tables and formulas have been increased in number and variety, and have been thoroughly revised to correspond with modern practice and the new shapes and dimensions of rolled and forged steel sections now available for the use of engineers. A brief summary of the principal contents will give a fairly complete idea of their nature to engineers who are not acquainted with former editions. These are as follows: Tables of Dimensions and Weights of Sections, 15 pages; Qualities of Structural Steel, 5 pages; Tables of Safe Loads and Spacing of I-Beams, 74 pages; Tables of Safe Loads of Other Rolled Sections, 14 pages; Supports and Connections for Beams and Girders; 2 pages; Approximate Formulas for Beams, 5 pages; Beams Subjected to Compound Stresses, 5 pages; Riveted Girders, 14 pages; Flooring and Fireproofing, 16 pages; Beams Supporting Brick Walls, 2 pages; Struts of Rolled Sections, 17 pages; Columns of Round and Square Sections, 5 pages; Elements of Pencoyd Shapes, 37 pages; Bending Movements and Deflections of Beams, 26 pages; Stresses in Framed Structures, 5 pages; Shafting, 7 pages; Turntables, 2 pages; Pins, Nuts, Clevises, Eyebars, Connections, and Purchasing Data, 28 pages; Bridge Specifications, 10 pages. An Appendix contains tabular information and discussions on wood, stone and materials of construction, strength of materials, foundations, crane chains, wrought iron pipe and rolled sheets. Following the Appendix is a series of tables showing weights of plates, flat bars, etc.; areas of circles; squares, cubes, reciprocals, etc.; trigonometrical functions; mensuration; electrical formulas, and measures.

The preparation of the tables and text has been carried out under the direction of Mr. James Christie, M. Am. Soc. C. E., Engineer, Pencoyd Iron Works, and give evidence of having been carefully compiled and verified. A fairly good index is provided.

THE CALORIFIC POWER OF FUELS.—Founded on Scheurer-Kestner's "Pouvoir Calorifiques des Combustibles." With Tables of Heats of Combustion of Fuels, Solid, Liquid and Gaseous. By Herman Poole, F. C. S. New York: John Wiley & Sons, London: Chapman & Hall, Ltd. Cloth; 8vo.; pp. 255; 40 illustrations. $3.

Works on fuel hitherto published in the English language contain only a few scattered facts in relation to their calorific powers. A small book recently brought out in France by M. Scheurer-Kestner, entitled "Pouvoir Calorifiques des Combustibles," is devoted entirely to the single subject, and M. Poole's work is based on a translation of that book, with changes necessary to adapt it to American methods and data, omitting many portions and adding new matter. The first six chapters, covering about one-third of the book, are devoted to definitions of fuels, heat of combustion, etc., and to descriptions of numerous forms of calorimeters that have been used by different experimenters. Then follow three chapters on fuels, solid, liquid and gaseous, and three chapters relating to the calorific power of coal burnt under a steam boiler, and including many practical directions in regard to boiler testing. An appendix gives the recent draft of report of the Boiler Test Committee of the American Society of Mechanical Engineers, which was issued in December last, "subject to revision," and a series of tables of constants and of fuel values attributed to different experimenters.

Mr. Poole's book, while essentially a compilation of existing literature on fuel calorimetry, with but little original matter, will be welcomed by students of the subject for its gathering together in handy form the information which has hitherto been scattered in many books and periodicals. It will be especially valuable in calling attention to the numerous sources of error in calorimetric work and to the serious defects in many old forms of apparatus. We think the author might have been more explicit in his condemnation of these old forms, and that he might have pointed out the fact that many of the published results which he gives without comment are intrinsically improbable. His chapter on liquid fuels is very brief and unsatisfactory. He quotes the reported result of a boiler test made in England with "blast furnace oil," whatever that may be, in which the yield is given as 89.87¼ of the theoretical, the heating value of the fuel being given by Thompson's calorimeter as 16,080 B. T. U. Both of these figures should have been given with a strong mark of interrogation, as should also the figure 20.8 lbs. evaporation per pound of oil reported from another boiler test. The fuel tables, covering 39 pages of the book, might have been condensed with advantage, as many of the figures given are more than doubtful, such, for instance, as Johnson's figures for Maryland coal, less than 12,000 B. T. U. per lb. combustible, and Barrus' figure for Cross Creek anthracite, 12,872 B. T. U. per lb. combustible.

ARITHMETIC OF THE STEAM ENGINE.—By E. Sherman Gould, M. Am. Soc. C. E. D. Van Nostrand Co., New York. Cloth; 12mo.; pp. 77. $1.

The author of this brief work is a well-known hydraulic engineer, and has made many excellent contributions to engineering literature; his "Hydraulic Formulæ" is familiar to most water supply engineers. The object of the present work, according to its preface, is:

To furnish a clear and concise digest of the fundamental principles of the steam engine, and the practical calculations based upon them. * * * It is believed that these few pages contain all that is necessary to solve the ordinary problems relating to steam in its application to the steam engine.

We regret to say that we consider that Mr. Gould has failed to accomplish his excellent intention. Many other writers of books on the steam engine have also failed for the same reason; that is, because they have attempted the impossible. It is not to be expected that any one can write a book containing only 67 pages of text, in large type, and ten pages of tables, to sell for a dollar, that will be a "clear and concise digest of the fundamental principles," and at the same time "contain all that is necessary to solve the ordinary problems relating to steam in its application to the steam engine." Besides having the fault of extreme brevity, it has also the fault of too much originality. Every page indicates that the author has written the work with his own pen as the result of his personal study of the problems of the steam engine. The result of this originality is that the book contains many blemishes, which might have been avoided if instead of using his own words the author had adopted those of the classic writers on the steam engine, such as Rankine and Clark. We give a few examples of these blemishes below:

P. 2. The quantity of heat which a body contains is "its temperature into its weight into its specific heat."

The use of the word "into" as a synonym for "multiplied by" may be criticised from a literary point of view, but the statement also is inaccurate. If a pound of superheated steam has a temperature of 500° F. and a specific heat of 0.48, its quantity of heat is not 1 × 500 × 0.48 = 240, as Mr. Gould's statement would indicate.

P. 9. "Temperature and sensible heat are generally considered as synonymous terms. Sensible heat is, however, always a little higher than the temperature, as is shown by Porter's tables."

We can only guess what the author means by this, since he does not define "sensible heat," and Porter's steam tables do not confirm his statement, as we understand them.

P. 56. "The engineering unit of virtual velocity is the horse-power, which is 33,000 ft. lbs."

This is the first time we have seen horse-power defined as the "engineering unit of virtual velocity."

P. 61. Momentum or "quantity of motion" is weight into time, and is expressed in second-pounds. Momentum represents the stored or acquired energy of weight acting through time.

The last sentence standing alone might be construed so as to show that a body at rest could acquire energy by acting through time. Of course, the author means to say momentum of a moving body, but even in that case his statement is lacking in precision. He gives the equation of momentum as $Ft = Wv \div g$, and then says momentum is weight into time. If we understand the formula, W is the weight of the moving body in pounds, and t is the time in seconds during which the constant force F has been applied to it to cause it to acquire the velocity v. According to Mr. Gould's statement, a force of 1 lb. applied by a string during 100 seconds to draw a 10,000-ton ship would produce a momentum in "second-pounds" equal to 100 times the weight of the ship in pounds.

P. 64. Vis viva represents the stored or acquired energy of weight acting through distance.

The author gives as the formula for vis viva the well-known formula for energy, $Fh = \frac{1}{2} W v^2 \div g$. It will be noticed that his definition of vis viva is exactly the same as his definition of momentum, except that the word "distance" is substituted for "time," but that the expression for vis viva, $\frac{1}{2} W v^2 \div g$, differs greatly from that for momentum, $W v \div g$. As far as we know, there is no warrant in the literature or in the logic of dynamics for defining momentum as a form of energy. The word energy is rigidly defined by all the authorities as $\frac{1}{2} M v^2$ or $\frac{1}{2} W v^2 \div g$, and never as $W v \div g$. The word vis viva is an entirely useless term in dynamics, since "energy" has taken its place. Mr. Gould would have done much better if in writing his pages on work, energy, etc., he had adopted the terminology of Rankine, and avoided any attempt at originality.

AMERICAN LOCOMOTIVES, to the number of 172, were ordered for export in April and May, says the New York "Journal of Commerce." Of this number the Baldwin Locomotive Works are building 77 for the Trans-Siberian and Chinese Eastern Railway; of these 50 are to be consolidated freight engines with tenders, and 27 will be tank locomotives, all of the Vauclain compound system. In addition to these the Baldwin Co. has booked orders since April 1 for ten locomotives for New Zealand, six for the Robla-Valmaseda Railway, of Spain, five for the Egyptian government, two for Argentina and one for Mexico. The Richmond Locomotive and Machine Works last week, received an order for 17 compound locomotives for the Finland State Railways. Among other late orders are 26 locomotives for the Nippon Railway of Japan, to be built by the Schenectady Locomotive Works; and the same firm will build 12 more for the Kiusiu Railway, of Japan. The Brooks Locomotive Works are making three passenger and two tank locomotives for the Haukaku Railway of Japan. Five other locomotives have been bought in the open market since April 1, making 172 in all actually ordered within the two months, and other important contracts are under negotiations with Russia and Mexico.

RUSSIAN IRON AND STEEL PRODUCTION, for 1896, is officially reported as follows: Cast iron, 1,612,034 metric tons; wrought iron, 502,243 tons; steel, 607,736 tons. This is an aggregate increase of 157,736 tons over 1895. The eight establishments of Middle Russia produced 638,744 tons, while the 91 private and 13 government establishments in the Ural produced only 580,798 tons. In 1896 the importation of cast iron amounted to 75,217 tons, as compared with 160,508 tons in 1893.

THE BRIGADE OF ENGINEERS to be organized, under a special act of Congress, is to comprise three regiments, with three battalions of four companies in each regiment. Each regiment will have 53 commissioned officers and 1,106 enlisted men. The officers will be selected for their skill as military, civil, electrical, mechanical or topographical engineers. An effort will be made to recruit the men from every branch of the engineering profession and of mechanical skill. These will include machinists, steam engineers, blacksmiths, carpenters, plumbers, telegraphers, topographers, draftsmen, photographers, railway men, riggers and boatmen and men skilled in the use of explosives. These volunteer engineer troops will be equipped and armed as infantry, and they will form the 1st, 2d and 3d Regiments of U. S. Volunteer Engineers.

THE POLLUTION OF THE PASSAIC RIVER by sewage has just been made the subject of another lawsuit. A few days ago application was made to the Chancery Court for an injunction to restrain the city of Newark, N. J., from constructing the proposed central relief outlet sewer. The petitioner has interests on the river close by the terminus of the outlet sewer and alleges that the sewer would be an intolerable nuisance and a danger to health. The case will be heard on June 7. A suit against the city of Paterson for a discontinuance of the discharge into the river of sewage from its whole sewerage system was instituted some time ago and a decision is expected at any time.

HOT-AIR MOTORS are discussed in "Dingler's Polytechniches Journal," for April 10, 1898. In attempts to improve existing machines Messrs. Lombaerde and Lecompte, of Paris, replace the air-compressor by an annular space around the motor cylinder itself. Mr. Korndoerfer, of Bohemia, is striving to maintain tightness and the lubrication of the cylinder at high temperatures. Mr. Ledin, a Swiss, proposes to employ as a motor-fluid a mixture of steam and the products of the combustion of petroleum in a closed vessel. Messrs. Rozer and Mazurier have patented a device for combining a hot-air and explosion motor, in such manner that the escaping gas of the one heats the air in the other motor.